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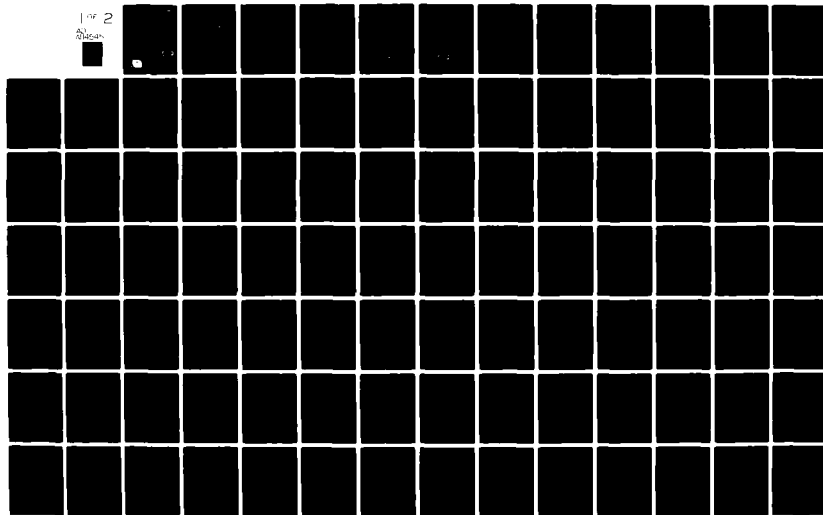
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OPTIONS FOR PROCURING ADEQUATE SUPPLIES OF PETROLEUM PRODUCTS

Wendy L. Gramm
Paul Munyon

July 1981

Prepared for
Defense Logistics Agency

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Price Adjustment) clauses, reduce the riskiness of a DFSC contract, and increase the use of evergreen (most-favored-seller) contracts.

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IDA STUDY S-530

**OPTIONS FOR PROCURING ADEQUATE SUPPLIES
OF PETROLEUM PRODUCTS**

Wendy L. Gramm
Paul Munyon

July 1981



**INSTITUTE FOR DEFENSE ANALYSES
PROGRAM ANALYSIS DIVISION
1801 N. Beauregard Street, Alexandria, Virginia 22311**

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P R E F A C E

This study was prepared by the Institute for Defense Analyses (IDA) for the Office of the Under Secretary of Defense Research and Engineering (OUSDR&E) under Contract No. MDA903 79 C 0018, Task Order T-9-067, dated September 1979 and amended May 1980.

The objective of this study was to determine the economic, logistical, and contractual feasibility of alternative methods for the Defense Fuel Supply Center (DFSC) to assure an adequate supply and reasonable prices for petroleum products to be consumed by the Military Services, with consideration of the institutional problems and constraints.

This publication is issued in fulfillment of the contract.

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FOREWORD

This study was prepared by the Institute for Defense Analyses (IDA) in response to Contract No. MDA903 79 C 0018: T-9-067 with the Defense Logistics Agency (DLA). It is the result of our analysis of the problem set forth in the task order.

We wish to thank the many individuals who helped us in the various phases of this project, including individuals at DFSC and in the oil and related industries. We also wish to thank the following economists for their participation in the study: Robert Kuenne, S.C. Maurice and Henry Steele. Finally, special thanks go to Admiral Robert James for his help and continued interest in this project. However, these individuals are not responsible for any errors that remain.

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EXECUTIVE SUMMARY

The Defense Fuel Supply Center (DFSC) is the management and procurement agency for petroleum for the Department of Defense (DoD). Its mission is to procure refined petroleum products to meet the worldwide requirements of the military services and the domestic requirements of federal civilian agencies. Historically, DFSC has been able to procure the quantities of refined products required at terms considered favorable to DFSC. In recent years, however, DFSC has experienced increasing difficulties in procuring adequate supplies of refined products. These difficulties are manifested in less product being offered, rising contracting costs, and an increasing number of refiners who object to various terms of the contract offered by DFSC. In 1979, the situation worsened significantly.

In this study we discuss the recent difficulties that DFSC has experienced in procuring refined products and explore the possible methods of eliminating or reducing procurement shortfalls (lack of coverage of requirements). We focus on the procurement of bulk refined product within the United States where shortfalls have been particularly severe. Furthermore, we concentrate exclusively on the peacetime procurement of product. During a period of national emergency, DFSC should be able to procure whatever product is required by using emergency measures, including Congressional action to implement new policy. Thus, our concern is with DFSC's ability to procure efficiently the total amount of its peacetime requirements on an on-going basis.

The procurement problem DFSC faces today is one of "needing" to buy more refined product than it is able to procure. This shortfall may be attributable to budgetary limitations (budget constraints) or to institutional restrictions, real or imagined, placed on the price DFSC can pay. At the heart of DFSC's procurement problem is the fact that the price at which refiners are willing to supply military product (the supply price)¹ has increased significantly in recent years; in other words, the minimum price suppliers are able to accept for product sold to DFSC has increased dramatically. When the increases in the refiners' supply prices encounter an upper limit on the price DFSC can or will pay, offers of military product in response to DFSC's solicitations decline.

A number of factors have contributed to the decrease in the supply of military product. These include changes in overall market conditions as well as the increased costs of offering and delivering product to DFSC as compared with doing so for a civilian commercial customer. The growth of the power of OPEC and the concomitant decrease in the supply of oil relative to the demand for oil which has occurred since 1970 are the two most important market conditions that have influenced the supply of product offered to DFSC. These changes have led to dramatic increases in the prices of all petroleum products. Furthermore, the problem of price increases for military products has been exacerbated by the relative increase in the demand for civilian products refined from the same part of the barrel as key military products. For example, the increased demand for naphtha to produce unleaded gasoline and

¹ Supply price for any good is the minimum price a supplier is willing to accept in order to furnish a specific quantity of an item to a buyer. Supply price for military product is comprised of four components: (1) alternate use value; (2) incremental processing costs; (3) surcharge; and (4) risk premium. See page S-4 for a more detailed discussion of supply price.

petrochemical feedstocks has placed increased pressure on the market for that part of the barrel required by DFSC for JP-4, naphtha-based jet fuel.

These changes in the state of the petroleum markets have made the alternative civilian markets relatively attractive compared to selling product to DFSC. In addition, the activities of various federal agencies have helped to make those alternatives even more attractive. For example, the tilt provision allowed refiners to allocate a disproportionate part of the cost of production to the price of gasoline and, thus, permitted the refiner to recover more of his costs by selling gasoline instead of military products.

Other market factors also have influenced the refiner's cost of selling product to DFSC. The most important of these is the uncertain nature of many refiners' crude supplies. Unstable political conditions in the Middle East constantly threaten the flow of oil from traditional sources of supply. Moreover, oil-producing countries are restructuring the relationships between themselves and their former concessionaires by selling greater quantities of oil through other channels. Consequently, major oil companies, as well as small refiners who formerly depended on major oil companies for their crude supplies, encounter periods when one or more of their sources may be reduced or disappear completely. High interest rates is another factor that has contributed significantly to increasing the cost of selling product to DFSC as compared with the cost of selling to a civilian commercial customer. The very high cost of borrowing has reduced the time between delivery and payment for most or all civilian commercial transactions; this is not true in the military market where the refiner often must wait several months for full payment. As a result, the relative cost of selling to DFSC has increased as opposed to selling in the civilian commercial market.

In order to understand how these and other factors have affected the supply of military product, the individual refiner's supply decision must be examined in more detail. An individual refiner will offer product in response to a DFSC solicitation only if he believes there is a reasonable chance that DFSC will pay his supply price. The supply price, or the minimum price the refiner must obtain to be able to sell product to DFSC, is the sum of four components: (1) alternate use value, the highest net profit obtainable from selling the relevant portion of the barrel to an alternative customer; (2) incremental processing charges, the extra cost associated with processing and delivering military product as compared to commercial product; (3) incremental contract costs (surcharge), the extra administrative cost incurred in doing business with DFSC that would not be incurred in doing business with a civilian commercial customer; and (4) risk premium, compensation for the extra risk of financial loss associated with a DFSC (government) contract.

The first component of a refiner's price, the alternate use value for product sold to DFSC, is based on the market price of other products that might have been produced from that cut of the barrel. The other three components are based on costs (or expected costs) associated with producing and delivering military product. While recent changes in the petroleum and other markets have contributed to dramatic increases in all the components of a refiner's supply price, significant increases in the last three components have resulted in the supply price for military products rising at a faster rate than the supply price for competing commercial products. A number of predictions indicate that the relative decline in the supply of military products will continue in the near to intermediate future.

Given DFSC's mission and its restrictive procurement budget, the market solution to their peacetime problem focuses

on increasing the supply of military product. Accordingly, this study analyzes the impacts that different procurement options may have on the supply of military product.

The procurement options analyzed are divided into two categories: indirect and direct methods of acquiring product. Indirect methods involve the acquisition of crude oil or some other commodity into usable refined products. Crude oil can be transformed into product using either processing agreements with refiners or crude-for-product exchange agreements with refiners or other firms. There are conditions under which indirect acquisition of petroleum products could result in a lower price and more secure supplies than direct acquisition methods. However, on average, the cost to government of petroleum obtained using indirect methods would tend to be higher. The security of supplies depends primarily on the security of sources of crude oil to the refiner--domestic sources tend to be more secure than foreign sources, and a larger number of sources tend to result in more secure product supplies. Thus, acquiring refined product directly from a refiner with a large number of crude oil sources, especially if some of those sources are domestic sources, tends to reduce the risk of non-delivery as well as the cost to government as compared with direct methods of acquiring product.

Direct acquisition methods involve writing contracts with refiners or other suppliers for the delivery of refined products. To increase supply using the direct acquisition method, DFSC must reduce the cost to the refiner of supplying military product. Lowering the relative cost of supplying to DFSC should result in larger offers to DFSC and the delivery of greater quantities of product. Methods of reducing the cost of supplying product to DFSC include the following:

- (1) Price Escalation Provisions. DFSC should restructure those price escalation provisions of the DFSC contract that

specify how contract price changes during the life of the contract. First, they should endeavor to reduce the length of time required for a refiner to receive full compensation under the price escalation provisions. This will work to reduce the interest charges that may be incurred by a refiner as the result of a delay in full payment and, thus, reduce the surcharge component of supply price.¹

Second, DFSC should take steps to alter the structure of the price escalation options so as to permit the writing of clauses that meet the needs of each specific type of refiner. These changes should result in a reduction in the time required to calculate the appropriate full payment price in the presence of changes in the market price for product. In addition, these changes should improve the method used to calculate the appropriate price change so as to capture properly changes in the effective supply price of the refiner's product.

The changes can be accomplished without going beyond the authority of the Defense Logistics Agency. The benefits derived from implementing these changes, particularly in periods of rapid price increases, should far outweigh any cost of implementation.

(2) On-Going Contracts. DFSC should consider writing evergreen ("most favorite seller") contracts with a large number of refiners. The form of such a contract would be essentially the same as the form of the typical civilian commercial contract. The contract would be presumed to be on-going until one or the other of the parties to the contract

¹At the time the research phase of this study was completed, DFSC was considering the possible implementation of some form of several of the recommendations made in this study. By the time of publication of the final draft of this study, DFSC had taken a number of steps to alter significantly its procurement and contracting procedures. To attempt to do more than discuss the situation as observed at the time of the study would condemn this report to never-ending revision.

gave notice of their intent to terminate. "Presumed" renewal of the contract, coupled with a notification-period stipulation, would reduce significantly or eliminate completely the risk in the current DFSC contract procedure associated with the long lead times required to negotiate such a contract. This reduction in risk should lead to a reduction in the risk premium component of supply price. Moreover, to the extent that the number of items needing to be reviewed in each price negotiation period would be reduced, the annual contracting and negotiating cost associated with a DFSC contract should also be reduced. This should contribute to a reduction in the surcharge component of supply price.

Providing most-favored-seller contracts with many refiners would allow DFSC to obtain the security of supply associated with a large number of crude sources and the logistical security of having numerous and geographically dispersed suppliers. The authority to change the DFSC contract to the most-favored-seller form resides within the Defense Logistics Agency, and the cost of implementing this recommendation should be small.

(3) Allocation. DFSC should consider reducing the financial riskiness of its contract by altering the default and allocation provisions of that contract. The most straightforward way to do so would be to include a commercial allocation provision in that contract. For many small and intermediate-size refiners, a reduction or elimination of the default-avoidance risk should significantly lower the risk premium component of their supply price. The cost of implementing this recommendation is small, and the authority to do so lies within DFSC.

A disadvantage of including the allocation clause in the DFSC contract is that such a clause would allow refiners to reduce the quantity of crude actually delivered to DFSC to

less than the full contract quantities if the refiners' crude supply were reduced. Hence, delivery of product to military users could be less than the required quantities, even though contract quantities covered the total requirement. The expected amounts delivered when allocation is allowed must be compared with the amount that DFSC would obtain through a standard solicitation if allocation were not allowed. If allocation is not allowed in a period of significant uncertainty, DFSC could find that *offers* fall short of military requirements, as occurred in 1979. In that case, DFSC would be allocated, in effect, before the contract period actually began. The question is, then, would the *de facto* allocation be greater or less than the allocation DFSC would have received if an allocation clause had been included in the contract and a disruption of crude supplies had occurred? A sensitivity analysis of possible scenarios relating to the use of an allocation clause is presented in this study.

(4) Other Contract Clauses and Revisions. The requirements for submission of cost or pricing data and compliance with cost accounting standards (CAS) contribute to the surcharge and risk premium components of a refiner's supply price. DFSC should work to reduce the impact of these two requirements on supply price by revising the methods used to compute the price-reasonableness range. This range should be calculated in such a way as to reflect the existence of the other components of supply price besides alternate use value. Implementation of this recommendation lies within DFSC/DLA's authority.

DFSC should also endeavor to obtain the cooperation of other agencies and Congress in reducing the number of socioeconomic clauses in the DFSC contract that are not directly applicable to the refining industry. This would also reduce the surcharge and risk premium components of the supply price for military product.

Chapter I

INTRODUCTION

The Defense Fuel Supply Center (DFSC), a branch of the Defense Logistics Agency (DLA), is the procurement center for petroleum products for the Department of Defense worldwide and for federal civilian agencies within the United States. Table 1 lists the quantities of various products procured domestically and worldwide, the dollar amounts spent by DFSC, and the total amount of products supplied for domestic use in 1979. As table 1 shows, almost half of DFSC's procurement budget was spent on JP-4, a jet fuel composed of naphtha (70 percent) and kerosine (30 percent). JP-4 is sometimes referred to as naphtha-based jet fuel and can be produced by very simple types of refining capacity. DFSC also procures JP-5 and JP-8--kerosine-based jet fuels. The "Other Products" category includes purchases of crude oil for the Strategic Petroleum Reserve, coal, specialty products and service contracts. Table 1 also compares the quantities procured domestically.¹ DFSC purchases account for a relatively small portion of domestic markets for refined products, except for the market for naphtha-based jet fuel.² Until relatively recently, DFSC has been able to procure efficiently the quantities of refined product required by the various client agencies it serves. In the last few years, however, DFSC has experienced significant

¹Note that the DFSC procurement figures are for fiscal year 1979, while the domestic-use data are for calendar year 1979.

²DFSC is essentially the only consistent purchaser of naphtha-based jet fuel. The difference in amounts listed in Table 1 are due primarily to differences in the periods (fiscal year as opposed to calendar year).

Table 1. DFSC PROCUREMENT, FY1979

Product	Worldwide		Domestic	
	Quantity ^a	Amount Spent ^b	DFSC Quantity ^a	Total Domestic Consumption, 1979 ^a
Aviation Gasolines	1.4	28.3	1.3	14.0
Jet Fuels				
JP-4	100.3	1,676.1	92.1	73.0
JP-5	26.2	441.2	20.9	318.6
Other	7.4	189.0	1.0	
Automotive Gasolines	9.0	185.9	6.1	2,566.1
Distillates	53.0	947.3	35.9	1,207.3
Residuals	18.9	254.0	16.8	1,029.9
Other	--	--	--	1,519.7
Total Petroleum Products	216.2	3,721.8	174.1	6,728.6
Other Products		362.5		
		4,084.3		

^a In millions of barrels.

^b In millions of dollars.

Sources: Defense Fuel Supply Center, *Summary of Procurement Statistics, Fiscal Year 1979, 15 December 1979*, and Department of Energy, Energy Information Administration, *Energy Data Report, December 1979*.

difficulties in procuring adequate supplies of petroleum products at prices consistent with the budgets of the various government organizations served. The purpose of this paper is to examine the procurement problems DFSC has encountered, to place those problems in a useful perspective, and to present an analysis of proposed alternative solutions to DFSC's problems. The largest single segment of DFSC's basic activity is the procurement of bulk petroleum products for the Department of Defense; consequently, work presented in this paper focuses directly on DFSC procurement of refined products in bulk quantities. In addition, the analysis focuses on the procurement process in a peacetime environment. DFSC should be able to procure product expeditiously during a period of national emergency using emergency measures, including Congressional action to implement new policy. Therefore, how DFSC can procure the total amount of its peacetime requirement on an on-going basis is the primary concern of this study.

DFSC's procurement problems result in part from changing institutional factors governing the way DFSC procures product. First of all, because DFSC procures for government agencies and can spend only those amounts appropriated by Congress for the procurement of refined petroleum products, they must acquire the adequate supplies desired while spending no more than the funds allocated--ergo, DFSC faces a very real budget constraint. Furthermore, DFSC has no direct influence on the quantities of refined product specified as the "requirements" of the various military services. A private sector customer may have no direct control over price; he does have control, however, over the quantity demanded and the funds allocable to the purchase of the product in question. DFSC has no control over the quantities required by its clients or over the funds allocable by those clients to the purchase of refined product.

The procedures used by DFSC in procuring product are dictated by the Defense Acquisition Regulations (DAR). Consequently, DFSC contracts are extremely cumbersome and contain many more clauses than a typical commercial contract. The negotiating procedure to be followed prior to the award of a contract is also prescribed by the DAR. According to the regulations, the procurement process is initiated by potential sellers of product responding to DFSC's "solicitation" or "Request for Proposal" with a formal offer.¹ Once the potential supplier makes an offer, the negotiation process can take up to four months.

Changing market conditions have resulted in the costs of such procedures and contract clauses becoming increasingly burdensome for many refiners. As a result, the price at which a given quantity of military product is offered for sale to DFSC has increased (the supply of military product has decreased). However, the decrease in supply alone should not prevent DFSC from accomplishing its mission. In theory, if the quantities of product needed exist, DFSC can, for some price, acquire the required product.

In sum, DFSC's procurement problems occur because the rising supply price for product is coupled with a limit on the price DFSC can or will pay for refined product. The most fundamental limit on price results from a fixed budget. If DFSC can spend no more than the funds allocated, at very high prices DFSC can purchase only small quantities of product. At some lower price DFSC can purchase those quantities required by the relevant client. At any price higher than a budget expending

¹ The solicitation for domestic purchases is over 100 pages long. In contrast, an oil company contract with a commercial customer is typically between six and ten pages long.

price,¹ DFSC would experience a procurement shortfall. In addition, DFSC could experience a procurement shortfall if there is any institutional upper limit on the price that DFSC could pay.

In recent years, the decreasing supply of military product combined with an upper limit on the price DFSC can pay has resulted in procurement shortfalls. These procurement shortfalls resulted in a six percent decline in inventories between September 1978 and 1979. In June 1979, DFSC's inventories were about eight million barrels short of storage objectives. In addition, by June 1979, 34 DFSC storage facilities had penetrated war reserve levels for petroleum fuels.² Procurement shortfalls were especially severe for the Bulk Fuels Division. Table 2 shows the products and amounts of shortages for various products procured by the Bulk Fuels Division as of September, 1979.

In summary, DFSC's procurement problems exist because the supply of military product has decreased rapidly in recent years, while the price DFSC can pay has been limited by its budget and by other institutional factors. In order to understand why supply has decreased so dramatically, we must first understand the factors underlying an individual refiner's supply price. Accordingly, Chapter II discusses in some detail the components of a refiner's supply price which is affected by market prices as well as the special costs of fulfilling a DFSC contract. Chapter III describes how changes in international and domestic markets for crude oil and refined product

¹ If one divides the funds allocated by the quantity to be procured, one gets the maximum average price per unit, P_p , that DFSC can spend without spending more than the allocated funds or procuring less than the desired quantity of product.

² "DoD Petroleum and Supplies," Report of the Investigations Subcommittee of the House Armed Services Committee, House of Representatives, 96th Congress, 2nd Session, June 10, 1980, pp. 4 and 5.

Table 2. PENDING PROCUREMENT ACTIONS
(DAL600-79-R-0795)

SUPPLEMENTAL OPEN RFP - INLAND/WEST COAST - PERIOD 1 OCTOBER - 30 MARCH 80			
PRODUCT	REQUIREMENT (gallons)	TOTAL OFFERED (gallons)	TOTAL SHORTAGE (gallons)
JP-4	397,552,224	128,872,360	268,679,864
JP-5	223,941,000	8,273,580	215,667,420
DF-2	18,900,000	-0-	18,900,000
AVGAS (100/130)	5,362,000	-0-	5,362,000
DFM	57,101,250	-0-	57,101,250
DFA	6,919,800	-0-	6,919,800
MUR	1,176,000	-0-	1,176,000
NSFO	23,100,000	-0-	23,100,000
FSL	3,024,000	-0-	3,024,000
FS6	6,090,000	-0-	6,090,000
SUPPLEMENTAL OPEN RFP DLAS00-79-R-0759 - EUROPE/ATLANTIC/WESTPAC - PERIOD 1 JUL 79 - 31 DEC 79			
JP-5	40,034,000	-0-	40,034,000
JP-4	44,450,008	-0-	44,450,008
DEEP FREEZE/ 1 DECEMBER 79 - MARCH 80			
DFA - 70°	600,000	-0-	600,000
SUPPLEMENTAL OPEN RFP - US GULF/EAST COAST - PERIOD 1 NOV - 30 MAR 80			
JP-4	78,625,000	-0-	78,625,000
JP-5	5,960,000	-0-	5,960,000
DFM	26,573,988	-0-	26,573,988
WESTPAC - ANNUAL PROCUREMENT - PERIOD 1 JANUARY - 31 DECEMBER 80			
JP-4	370,760,000	336,637,000	34,122,000
JP-5	132,536,000	10,000,000	122,636,000
Kero	840,000	-0-	840,000
FSL	3,150,000	-0-	3,150,000
EUROPE/ATLANTIC/MED - PERIOD 1 JANUARY - 30 JUNE 80 ^a			
JP-5	52,304,000	-0-	52,304,000
JP-8	116,000,000	98,935,920	17,064,080
DF-2	26,642,000	11,130,000	22,260,000 ^b
^a This is the last six months of the regular Europe/Atlantic MED procurement. RFP DLA-79-R-0852 opened 10 September 1979.			
^b The 11,130,000 gallons DF-2 is offered by MOH. He is offering Jet A-1 and DFM as a substitute product for DF-2. This will only meet the Turkey requirement which is 4,382,000. This then leaves a balance of 22,260,000 of DF-2.			

Sources: *Loc. cit.*

have influenced the structure of prices that DFSC must pay in order to acquire adequate supplies of product. Chapter IV describes how those changes have interacted with DFSC's basic procurement procedures as prescribed by the Defense Acquisition Regulations to influence the DFSC-specific price.

Solutions to DFSC's procurement problems must include methods to increase the supply of military product available to DFSC. This means taking actions that will reduce the refiner's supply price by lowering the cost of supplying to DFSC as opposed to a civilian customer. Furthermore, as long as the quantities required by DFSC are on the "market" and there are no legal prohibitions on selling refined product to DFSC, DFSC's objective must always be to acquire the largest percentage of the specified requirement possible within its budgetary limitations. Alternatively, DFSC must acquire the total quantity required at the lowest total expenditure possible.

Chapters V through VII present an assessment of how alternative methods of procuring refined product would influence DFSC's ability to perform its mission and recommend actions that could improve DFSC's procurement posture.

Chapter II

MARKET PRICE AND QUANTITY

This chapter begins the examination of the market environment in which DFSC functions by examining the parameters that affect a refiner's decision to offer product for sale. Section A presents a brief description of the refining process as it relates to forces which influence the market price of product. Section B describes how the market prices for refined products paid by different customers are determined. Section C describes the process involved in an individual refiner's decision to supply product to one or more customers.

A. THE REFINING PROCESS

Crude oil can be refined into a variety of products. The kinds of products produced and the relative yields of each product produced by a refinery--the refiner's slate of product--depends on the qualities of the crude oils refined and the technology of the refinery. Table 3 shows the slate of products available from two different types of refineries; Table 4 shows how the products obtained from distillation differ for different crude types.

The simplest type of refinery is a straight still. In a straight still, the crude oil is heated until it vaporizes. As the vapors rise and cool, they condense, with different products condensing at different temperatures. Light products such as gasoline--often referred to as the *top of the barrel*--are those products which condense at lower temperatures and thus rise higher in the still tower before condensing. The

Table 3. PRODUCT SLATES FOR REPRESENTATIVE REFINERIES

Product Slate	Large Refinery	Small Refinery
Motor gasoline	50%	21%
Kerosine	8%	8%
Distillate Fuel	25%	19%
Residual Fuel	17%	52%

Source: Chase Manhattan Bank, as reported in Lundberg Letter, Vol. VII, #46, September 12, 1980.

Table 4. PRODUCTS DISTILLED FROM TWO DIFFERENT CRUDE OILS

Products	Percent	
	Brazoria City, Texas API Gravity 31.7°	Boscan (Venezuela) API Gravity 11.3°
Gasoline and Naphtha	20.1	3.6
Kerosine Distillate	--	--
Gas Oil ^a	36.9	12.6
Lubricating Distillates	22.7	13.8
Residuum ^b	20.3	66.8
Distillation Loss	0	3.2
	<u>100.0</u>	<u>100.0</u>

^aMiddle distillate, diesel fuel.

^bResidual heavy fuel oil.

Source: Crude petroleum analysis was obtained from the Bureau of Mines, 1980.

heavier ends of the barrel condense at higher temperatures and are captured lower in the still tower. Quantities of each type of product obtained in each condensation temperature range depend on the characteristics of the crude oil load put into the straight still. In other words, the "natural yield"

of the crude oil input influences strongly the output produced using the straight still process. Very little variation in output from the natural yield of crude oil is possible using the straight still technique.

Many outputs produced by the distillation process can be refined further using downstream capacity such as reforming or cracking equipment. Such equipment is used to rearrange the hydrogen and carbon molecules, producing a different product mix from a given crude oil input. Downstream capacity may be extremely expensive, but it permits the refiner to exercise greater control over the mix of products produced. In turn, this gives the refiner greater flexibility in his efforts to maximize the total revenue generated by the refining process. The costs of various kinds of conversion units (downstream capacity) as compared to the *atmospheric crude still* are presented in Table 5.

Table 5. COSTS OF DOWNSTREAM CAPACITY, 1973, 1980

Units	Capacity (barrels per day)	Estimated Cost, 1973	Estimated Cost, 1980 ^a
Atmospheric Crude Still	100,000	\$ 5,000,000	\$ 8,700,000
Coker	23,760	16,000,000	27,900,000
Hydrotreater	18,040	1,500,000	2,600,000
Cat Refiner ^b	24,930	7,100,000	13,900,000
Cat Cracker	32,300	12,600,000	21,900,000
Hydrocracker ^b	16,930	15,400,000	27,600,000

^a1973 costs were inflated to yield 1980 estimates using Nelson Indices for refining construction and catalyst costs. Obtained from the Statistical Department of the *Oil and Gas Journal*, 1980.

^bCatalyst cost for initial charge is included (\$15 million for reformer and \$3.2 million for hydrocracker in 1980 dollars).

Sources: James H. Gary and Glenn E. Handwerk, "Petroleum Refining," Marcel Dekker, Incorporated, New York, 1980, and Basel, Page 234, *Oil and Gas Journal*, 1980.

It should be noted that downstream capacity generally is configured to utilize specific types of intermediate products as inputs. For example, a catalytic reformer may take straight run gasoline (hydrocarbon condensing between 400° and 650°F) and turn it into higher octane gasoline. A catalytic cracker takes heavier oils and produces lighter products. The gasoline and oils produced using the reforming and cracking units are then blended with products from other such conversion units to yield the refiner's product slate. Since the quality and character of the initial crude input determines the amount of each type of intermediate hydrocarbon obtained from the first stages of refining, these characteristics also affect the rate at which different types of downstream capacity can be utilized. In general, refineries mix crude oils to generate an output slate from the first stage of refining that is within the desired quality range for effective utilization of the downstream capacity. A refinery with extensive downstream capacity is configured to use a mix of crude oils with fairly specific qualities. Clearly, even for complex refineries, the crude oil input is an important determinant of the slate of final products produced.

Finally, it is important to note that crude oil refining produces joint products. As shown in Tables 3 and 4, the distillation process combined with the natural yield of the particular crude oil produces a given slate of products. Using the distillation process to produce light products results in the production of heavy products as well. Thus, in order to produce for sale a larger quantity of a particular light product, it is necessary for a refiner using a straight still to also produce (and utilize in some way) a larger quantity of heavy products. Downstream capacity may enable a refiner to increase the output of a particular cut of the barrel without significantly increasing output of many other cuts of the barrel; however, even sophisticated downstream capacity has

limitations on its ability to produce output within a narrow range of the barrel. Moreover, given the capital intensity of downstream capacity, it is likely that the ability to produce hydrocarbons from the downstream capacity will typically be significantly smaller than the output potential of the distillation equipment.

In summary, there are four characteristics of the refining industry that are of particular importance for understanding the market environment in which DFSC procures product. First, the types of products and quantities of those products obtained from a given refinery depend on the refinery technology and the crude oil input mix. Second, the product slate obtained cannot be easily or cheaply altered in a short period of time. Third, efficient operation of any particular refinery involves producing a specific slate of products and using a specific type of crude input. Finally, refining produces joint products--increasing refinery runs to produce more of a desired product will also produce more of other products, which must be placed on the market.

B. THE PRICE OF A PRODUCT

The minimum price that any refiner will accept to bring a particular product to the market is the firm's "supply price" for the quantity of the specific product offered. In the markets in which DFSC is a purchaser, a refiner's supply price is made up of four components: (1) the alternate use value of the cut of the barrel used to produce the specific product in question; (2) any extra charges associated with transforming the alternate product into the desired product and delivering it; (3) a surcharge for any extra costs associated with doing business with DFSC as opposed to doing business with other customers; and (4) a risk premium to compensate the refiner for any special risks of financial loss associated with doing business with DFSC.

1. Alternate Use Value

The alternate-use-value component of a refiner's supply price is market-determined. The alternate use value of a product is the best net revenue a refiner can expect to obtain from existing or potential on-going contracts for the product in question or for other products refined from the relevant cut of the barrel. In other words, it is the net revenue obtainable from making the best on-going use of the cut of the barrel in question. As such, alternate use value is directly related to the market price of the product or products refined from the relevant cut and, therefore, is determined by the market for those products.

Consider, as an example, the simple determination of the alternate use value of JP-4 (70 percent naphtha and 30 percent kerosine). For a refiner without downstream capacity, the alternate use value is simply the best price that a refiner can expect to get from selling those two separate cuts of the barrel to other refiners or to end users. For a refiner with reforming capacity, the alternate use value might be the net price of unleaded gasoline (price net of extra refining costs associated with turning naphtha into unleaded gasoline), plus the contract price for jet kero (kerosine used as commercial jet fuel).¹ In either case, it is clear that the alternate use value is determined by a market price for another product and thus by the interaction of supply and demand in another market and not by the "cost of production" associated with the product in question.

As alternate use value and market price are essentially the same concept, it is relevant to ask "whose market, or which market?" The typical refiner has a number of alternatives

¹ The component of JP-4 may be used a number of ways by a variety of end users. The alternate uses discussed here are offered strictly as examples of determinants of alternate use value.

available that influence the character of the "market" and set out the various choices available with respect to alternate use value. The three general categories of options can be described as follows: (1) refine crude oil and sell product to local customers; (2) refine crude oil and transport refined product to a geographically different market; (3) sell crude oil to another refiner. The refiner will choose the alternative that generates the greatest net revenue. This largest net revenue is the measure of alternate use value to be used in assessing any new options a refiner might face.

A small refiner located in a geographically isolated market would normally be able to realize the greatest net revenue by selling to customers in that isolated market. In general, the cost of transporting refined product into another market or the cost of transferring a refiner's crude to an alternate user would be so large that the net revenue obtainable from either of those alternatives would be significantly smaller than that obtainable by selling to local customers.¹ It should be noted, however, that if market conditions change so that the differential between local market price and the price obtainable in a distant market increased to greater than the cost of transporting the product from the refinery to a distant market, the refiner would cease to serve the local market (at the end of the current contract period) and sell his product in the distant market. Thus, the net revenue obtainable from selling in the distant market would then become the alternate use value to be taken into consideration in determining whether or not to supply product. In this last example, the extent of the available market has increased for the refiner.

¹The cost of transporting crude and refined products varies according to the mode of transportation. These costs are discussed in more detail in Chapter III.

The importance of potential customers or markets must be clearly recognized in evaluating the alternate use value for a refiner. Although a refiner may have no immediate alternate customer for a particular product, such as JP-4, the refiner may have the possibility of producing another product for another market by installing some form of downstream capacity that would allow the refiner to serve alternate customers. If the price a refiner expected to receive for JP-4 were less than the projected net revenue obtainable from selling unleaded gasoline and jet kero, after one takes into account a reasonable rate of return on the capital that must be invested to install the downstream capacity, the refiner would discontinue production and sale of JP-4 and produce and sell unleaded gasoline and jet kero. Although at any point in time a refiner may appear to have a limited number of market options and, therefore, a constrained set of choices for the alternate use value of the product he produces, the existence of potential alternative markets or alternative product markets that can be serviced by modification of the refinery technology influences the alternate use value of products currently being produced. Moreover, once the investment in downstream capacity has been made, customers who wish to purchase products that do not make use of that downstream capacity must expect to pay the full alternate use value to the refiner--the alternate use value of those products that could be produced using the downstream capacity.

Another issue that should be examined is the impact on the alternate use value component of supply price *increasing* the production of a particular product. Two considerations are important: (1) the impact of increased production on the product's market price; (2) the impact of increasing production on the price of other products. Suppose the product being considered is JP-4. Suppose also that the market for the alternative, gasoline, is in equilibrium (or a surplus

exists). If the extra quantity of gasoline were large relative to the total market for gasoline, placing this extra quantity on the market would cause the price to decline. Thus, the alternate use value for JP-4 is less than the current market price for gasoline. If there is excess demand in the market for gasoline, the alternate use value will be greater than the current price for gasoline.¹

Since refining produces joint products, the alternate use values for increased quantities of products also are influenced by the market for other products. In general, if a refiner increases the quantity produced of one product, the refiner must also increase the quantities produced of other parts of the barrel as well. If the markets in which the other parts of the barrel are sold are less robust than the market for the "desired product," the prices for those other parts may actually be depressed. Thus, it is possible that the net revenue generated in the less desirable markets would actually be reduced. This reduction in net revenue associated with the necessity to dispose of the additional quantities of the other parts of the barrel produced must be charged against the revenues generated by selling the desired product. In such a case, it is possible that the net revenue obtainable from the alternate use of a particular cut of the barrel would be significantly below the market price for the product obtained from that cut of the barrel. Over time, a refiner may alter the refinery's technology to increase the production of the desired product and decrease the production of the other cuts of the barrel. However, such technological modifications are costly and thus must be motivated by more than short-term changes in particular markets for refined products.

¹This assumes prices are allowed to adjust to equilibrium. If there is a price ceiling on gasoline, the alternate use value component of JP-4 in the excess demand case may be the ceiling price.

In summary, the alternate-use-value component of a refiner's supply price for a particular product is determined by market forces and the alternative markets available to the refiner. As such, the alternate-use-value component of supply price will vary from refiner to refiner. Thus, the alternate use values for a particular cut of the barrel may be small for refiners employing simple (limited) refining technology or servicing geographically isolated markets as compared to the alternate use value for the same part of the barrel for a refiner with sophisticated downstream capacity or easy access to a broad range of product markets.

2. Incremental Processing Costs

If a particular product involves more processing than similar products refined from that cut of the barrel or if the refiner must arrange for transportation or storage of the product in some astandard manner, these additional costs are added to the alternate use value of that cut of the barrel in determining the minimum price at which the refiner will supply product. Like alternate use value, the incremental-processing-cost component of supply price will vary from refiner to refiner. However, unlike alternate use value, the processing cost component is a cost-determined rather than a market-determined component of supply price.

3. Incremental Contract Costs--Surcharge

The third component of supply price is the surcharge. This element of supply price compensates the refiner for the added administrative costs incurred in doing business with a particular customer that would not be incurred in doing business with other customers. If there are costs incurred in satisfying particular contract clauses unique to a particular customer's contracting procedures, these costs would be part

of the surcharge component. In addition, if the manner or timing of a customer's payment system imposes additional financial costs on a refiner that would not have been incurred by doing business with a typical customer, those costs would be added to the surcharge component. Like the incremental-processing-cost component of supply price, the surcharge component is cost-determined rather than market-determined.

4. Risk Premium

All other things being equal, a refiner (supplier) will prefer to engage in a transaction that involves less risk as opposed to one that contains more risk. Therefore, in order for a refiner to be induced to supply product in a risky market, the refiner's supply price must contain compensation for bearing that risk--a risk premium. This premium is the compensation a supplier must receive in order to be willing to accept the larger exposure to possible adverse financial consequences associated with supplying under "riskier circumstances."

Consider, for example, the small refiner faced with the choice between supplying product to a customer with a contract containing an allocation clause or to a customer with a contract that does not contain an allocation clause.¹ If the same product specification and delivery terms apply for both potential customers, the alternate use value, incremental cost component, and surcharge component should be the same for both customers. However, the customer whose contract requires that 100 percent of the contract quantities always be delivered is imposing a risk of an additional financial burden on the refiner. This risk is not imposed on the refiner by the customer with an allocation clause in his contract. Thus, if

¹An allocation clause allows the refiner to deliver less than contract quantities in the event the refiner's crude supply is disrupted.

a customer who does not allow allocation wishes to be as desirable to a refiner as a customer who does allow allocation, the risky customer must pay a risk premium as part of the price of the product delivered. The refiner must be fully compensated for the risk of supplying under a no-allocation contract or the refiner will supply a less risky customer instead. In essence, the market in which the "risky customer" or group of risky customers purchases product will be a different market from the one in which the less risky or riskless customers purchase product. A refiner's supply price will be higher in the risky market than in the less risky market. How much higher, or the value of the risk premium, depends upon the refiner's expected cost of delivering on a risky contract. This can be viewed as the average extra cost of the riskier contract over a number of periods. The risk premium would be calculated in a manner similar to what an insurance company would use to calculate an insurance premium.

5. Supply Price Reconsidered

Each refiner's supply price for a particular product market will be composed of four components: (1) alternate use value; (2) incremental processing costs; (3) surcharge; and (4) risk premium. The value of each component and, hence, the effective supply price for each refiner may be different. Figure 1 illustrates different possible combinations of the four components and the resulting supply prices for different refiners. It is worth noting that there need be no firm relationship among the various components from refiner to refiner. It is quite conceivable that a refiner with access to a large number of alternative markets would have a very high alternate use value component, while at the same time the potential exposure to financial loss associated with supplying in a particular market could be quite small. On the other

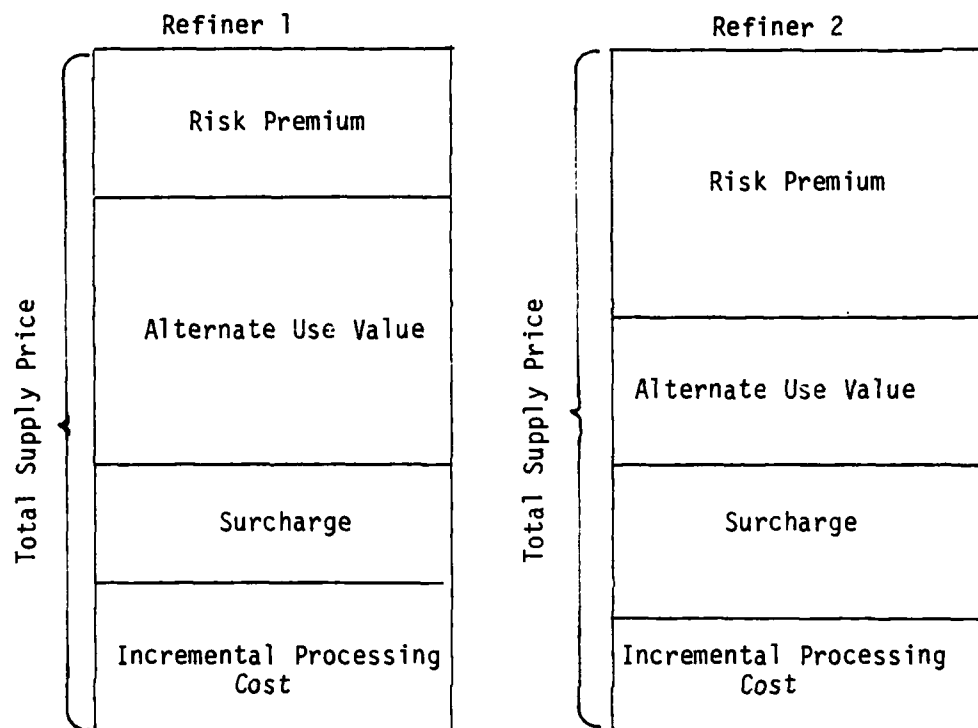


Figure 1. SUPPLY PRICE COMPONENTS

hand, a small refiner serving a geographically isolated market could have a relatively low alternate-use-value component, with a large risk premium component in his supply price. In addition, it may be that the supply price for any given refiner will change with the quantities to be offered to any given market. This could be the result of a change in the alternate use value associated with shifting resources from one market to another or, perhaps, a change in the risk premium resulting from increased or decreased exposure to possible financial loss associated with a change in the quantities supplied to different markets.

For an individual refiner to be willing to supply product to customers in a particular market, the price the refiner can obtain for doing so must be greater than or equal to the refiner's supply price for the quantity to be delivered. If the various supply price relationships of the different refiners are summed, a market supply relationship (supply curve) is derived which describes the offer possibilities faced by customers in a particular market. The next section of this chapter deals in more detail with various aspects of the refiner's decision to offer or supply product in any market.

C. THE DECISION TO OFFER OR SUPPLY

In theory, a refiner will offer a product to a customer as long as the customer is willing to pay the refiner's supply price. Nevertheless, there are a number of practical reasons why a potential customer may not receive offers for product from refiners.

Consider the market for a particular refined product characterized by increasing demand relative to supply. If at a particular point in time the actual market price is below the equilibrium price, so that there is excess demand for the product at the prevailing price, not all potential customers may receive offers of product. In general, prices in markets for refined petroleum products adjust very rapidly, and a limited amount of rationing among customers is necessary. However, when government regulation or other activity inhibits the market adjustment, refiners typically ration excess demand by allocating existing customers. Such a case occurs with price controls on various petroleum products. In this case, the controlled price is below the price necessary to equate quantities supplied and demanded and some demand goes unsatisfied. If the structure of a market is such that there are

on-going consumer relationships that must be periodically renewed or reestablished, one would expect that customers without on-going relationships would find that they bore the brunt of the gap between the quantity demanded and the quantity supplied of product at the prevailing price until actual price rose enough to equilibrate quantity demanded and quantity supplied.

In market situations where information is incomplete or where complete information is costly to obtain, potential customers may find themselves without adequate offers. If refiners believe, correctly or not, that they will be unable to obtain their supply price for product offered, they will not offer product. If the "offering process" is a lengthy one and involves real out-of-pocket costs, refiners may not offer product because they do not believe that they can be compensated for the basic supply price of the product as well as the cost of acquiring the information. For the smaller refiner (supplier) with extremely scarce managerial or information-seeking resources, the effective cost of acquiring information about a particular market may be high enough to prevent the refiner from even considering entering the market. In summary, potential customers may be left unsatisfied if suppliers do not believe that they can expect to receive their supply price from those potential customers or if there are genuine costs to be incurred in determining whether or not the supply price can be obtained.

Chapter III

INTERNATIONAL AND DOMESTIC OIL MARKETS: AN HISTORICAL OVERVIEW

A clear perspective on DFSC's procurement problems and on the potential for success of various alternative solutions requires an understanding of the market environment in which DFSC must function. This chapter provides an historical overview of the market environment in which DFSC functions and analyzes how some of the significant changes of the last three decades have influenced the current structure of that market environment. Section A examines the period of the 1950s and the 1960s; Section B examines the 1970s; and Section C examines a set of projections for the early 1980s.

A. THE 1950s and 1960s¹

The most striking feature of the twenty years from 1950 to 1970 is the *falling real price of crude oil and of refined product*.² Table 6 shows the estimated U.S. and world real prices for crude oil between 1950 and 1977. This trend is corroborated by price information collected by the Bureau of Labor Statistics (BLS). The BLS wholesale price index on crude oil increased 1.6 percent between 1957 and 1968. During

¹This section provides an overview of petroleum markets. For more detailed descriptions and data, the following references are particularly helpful: M.A. Adelman, "The World Petroleum Market," Johns Hopkins University Press, Baltimore, MD, 1972; E. Anthony Copp, "Regulating Competition in Oil," The Texas A&M University Press, 1976; Bureau of Mines, *Mineral Yearbook*, various years; and H.B. Steele and J.M. Griffin, "Energy Economics and Policy," Academic Press, Incorporated, 1980.

²Real oil prices are prices adjusted for the rate of inflation.

Table 6. REAL PRICE^a OF U.S. AND WORLD CRUDE OIL

Year	U.S. Real Price (in 1951-1959 dollars per barrel)	World Real Price (in 1951-1959 dollars per barrel)
1950	\$3.01	\$2.04
1955	2.97	1.75
1960	2.70	1.43
1965	2.50	1.43
1970	2.37	.94
1971	2.34	1.14
1972	2.26	1.23
1973	2.53	1.89
1974	3.85	6.15
1975	4.10	5.73
1976	4.01	5.70
1977	3.90	6.22

^a Price deflated to real price using U.S. Consumer Price Index.

Source: H.B. Steele and J.M. Griffin, "Energy Economics and Policy," Academic Press, Incorporated, 1980, Page 18.

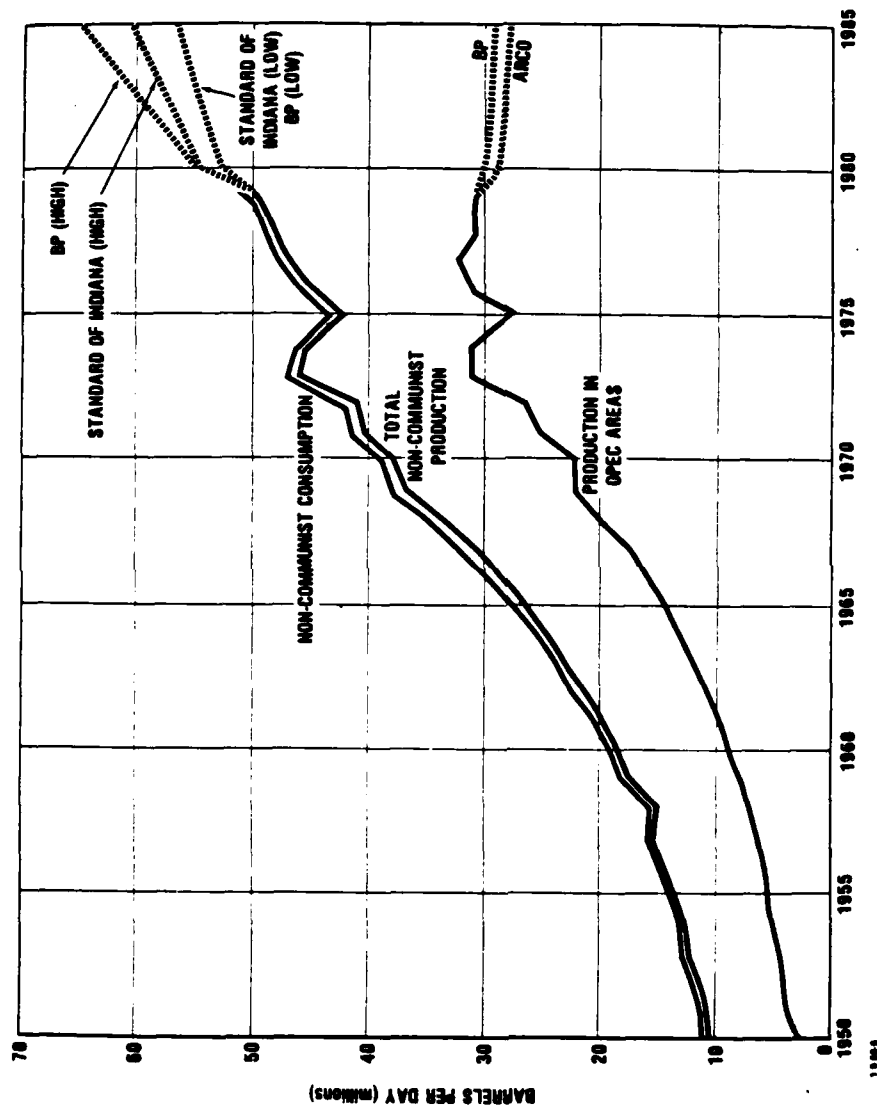
the same period, the index for refined products increased 5.7 percent, while the (wholesale price) index for other commodities increased 9.9 percent. Thus, the real price decreased for both crude oil and refined products.¹

A number of factors help explain the phenomenon of falling petroleum prices, but the primary factor has to do with the tremendous supply-side pressure that was exerted on the market for crude oil right up to the beginning of the 1970s. Prior

¹ *Mineral Facts and Problems*, U.S. Department of the Interior, Bureau of Mines, 1970, page 163.

to 1970, oil-producing countries were essentially unable to influence upward the market price for their crude oil. Any attempt by an oil-producing country to raise the price of its oil by reducing its output would have been met by an offsetting increase of production in other oil-producing areas, including the United States. Thus, one country's decrease in production would have had no impact on the market price for crude, but would have left that country with reduced oil revenues. Under those circumstances, a country that wanted to increase oil revenues had to concentrate on increasing oil liftings rather than on price. Competition among existing concessionaires and companies seeking to be new entrants into the market for drilling rights in the Middle East and North Africa made existing concessionaires very responsive to oil-producing countries' desires to increase the production of crude oil. Thus, for nearly two decades major oil companies put ever-increasing quantities of crude oil on the world market. This consistently expanding supply of crude oil kept real oil prices from rising and, coupled with other market forces, contributed to a general decline in the real price of crude oil. Figure 2 shows how total consumption by non-communist countries was influenced by production in OPEC areas. This figure shows that during the 1950s and 1960s, the increase in total consumption was primarily due to the increase in production in OPEC areas.

Ever-increasing quantities of crude oil being placed on the world market had to be moved. The major oil companies responded to this challenge in a number of ways. In the United States, oil companies invested heavily in distribution systems that would allow them to sell product on a continuous basis. In addition, those oil companies with access to substantial supplies of crude were willing to participate in a system of third-party sales that allowed the development of a small refining sector that was not connected in one way or



Sources: *Oil and Gas Journal*, various issues, and the British Petroleum Statistical Record of the World Petroleum Industry, British Petroleum, various issues.

Figure 2. CRUDE OIL PRODUCTION, AND CONSUMPTION IN THE NON-COMMUNIST WORLD, AND IMPORTS FROM COMMUNIST AREAS, 1950-1978/79, WITH PROJECTIONS

another to the exploration for and development of crude oil supplies. Concomitant with this, the relative cost of building refining capacity and transporting crude oil versus the cost of transporting refined product resulted in a domestic refining industry characterized by a large number of small refineries built to serve local or specialty markets. Many of those refineries continue to produce today.¹

Tables 7 and 8 show the cost of the various forms of transportation and some estimates of the cost of refining capacity in selected years. In general, the cost of transportation increases the smaller the vehicle used, with tank trucks being the most expensive mode of transportation. In addition, the cost of transporting "clean" products (gasoline, kerosine, etc.) is much higher than the cost of transporting "dirty" products (crude oil and residual fuel oil) for most modes of transportation.² The cost of transportation relative to refining costs is important in determining the structure of the refining industry. Government regulation also has had an important impact on industry structure, at least in part because of the impact of regulation on relative costs. For example, the small refiner bias has meant favorable treatment for small refiners in a number of cases, including import quotas (1959-1973) and Small Business Administration programs. As can be seen by Table 9, the American refining industry has many small refiners. In 1974, the average size of the U.S. refineries was about 60,000 barrels per day as compared to the 130,000 barrels per day average for European Economic Community (EEC) countries.³

¹A more detailed description of the structure of the domestic refining industry and its development can be found in E. Anthony Copp, "Regulating Competition in Oil," and M.A. Adelman, "The World Petroleum Market," *loc. cit.*

²*Mineral Facts and Problems, loc. cit.*

³See "Refining Report," *Oil and Gas Journal*, March 24, 1980, page 76.

Table 7. TRANSPORTATION COSTS OF CRUDE AND PRODUCTS, SELECTED YEARS

Mode	Transportation Cost of Crude, 1969 (Cost in Miles per Ton-Mile) ¹
Tankers	\$1.0 - \$2.0
Barge	1.5 - 6.0
Pipeline	1.7 - 6.0
Tank Car	20 - 70
Tank Truck	30 - 50

Pipeline	Estimated Transportation Cost, 1976 (Cost per Barrel-Mile) ²
Crude Oil	.051¢
Refined Products	.075¢

¹*Mineral Facts and Problems*, Page 166, *op. cit.*

²Pipeline operating revenues for trunk lines for all pipeline companies divided by number of barrel miles of crude or products transported on trunklines. Data obtained from "Transport Statistics in the United States for the Year Ended December 31, 1976," Part 6, "Pipe Lines," Interstate Commerce Commission, Bureau of Accounts, Washington, D.C., pp. 3 and 20.

Table 8. ESTIMATES OF REFINERY CAPITAL COSTS

Western European Refinery Capital Costs (All Refineries)	
Year	(Cents per barrel)
1960	19.3
1965	19.1
1969	21.0
Crude Topping Plants (Less than 30,000 barrels per day)	
1963	4.85
United States Refinery Costs (Capital Costs for California-Major Refineries Only) ^b	
Year	(Cents per barrel)
1968	14.23
Total Cost of Refining (All U.S. Refineries)	
Years	(Cents per barrel) ^c
1958-1966	62 - 77
1964-1966	53 ^d

^aSee M.A. Adelman, page 377 for all refineries, and page 381 for crude topping plant estimates, *op. cit.*

^bSee California Legislature's *Joint Committee on Public Domain*, Kenneth Cory, Chairman, October 1974, page 44.

^cIPAA estimates as reported in M.A. Adelman, page 375, *op. cit.*

^dSee OGJ estimates as reported in M.A. Adelman, page 376, *idem.*

Table 9. STRUCTURE OF REFINING INDUSTRY

United States versus Europe, 1980 ^a		
Characteristics	United States	Europe ^b
Number of plants with less than 50,000 barrels per day capacity	202	26
Percent (of total) with less than 50,000 barrels per day capacity	68%	16%
Average Capacity	59,902 barrels per day	127,604 barrels per day
United States Refining Structure, Selected Years ^c		
Characteristics	1961	1979
Number of refineries	283	299
Number of refineries with less than 8,000 barrels per day capacity	108	75
Percent (of total) with less than 8,000 barrels per day	38%	25%

^aSee "Annual Refining Survey," and "Worldwide Refining," *Oil and Gas Journal*, March 24, 1980, pp. 130-163 and December 31, 1979, pp. 127-163, respectively.

^bIncludes UK.

^cSee National Petroleum Refiners' Association, Refining Capacity Reports, 1961, 1979.

Significant changes also took place during these two decades in the structure of the demand for refined products and thus for crude oil. Falling real oil prices stimulated consumers and producers to become much more energy-intensive in consumption and production. Given the relative prices, it was optimal to provide for comfortable building temperatures by heating and cooling systems rather than by using insulation. Consumers expanded their use of small appliances and their

private automobile. It was also optimal to substitute more energy for other inputs such as labor or capital equipment in the production process. Clearly, in the face of falling real oil prices, to be economical and efficient meant to use more energy and to conserve on other scarce resources. Consequently, demand-side pressures were created that would continue to be present in the market even after supply conditions changed in the 1970s.

In summary, in the 1950s and 1960s oil-producing countries sought to raise oil revenues through the only vehicle available to them--the increased production of crude oil. This forced real-world oil prices lower and further exacerbated the problem faced by oil-producing countries. Faced with the necessity of lifting ever-increasing quantities of crude, oil companies had to find distribution systems for that crude. Thus, they invested large sums in integrated distribution systems and were willing to cooperate in the development of a small refining sector in the American economy as a means of having an outlet for some of the crude oil. The economies of developed and developing countries responded to the falling real price of oil by substituting energy for other resources in consumption and production. By 1970 there was a world that had grown used to ever-cheaper petroleum-based energy, an abundant supply of that energy, a refining industry in the United States that included many small refiners oriented toward local or specialty markets, and economic activity that was heavily dependent on crude oil and refined products as inputs.

B. THE 1970s

The 1970s were characterized by increasing real oil prices, growing uncertainty among oil companies, both large and small, about the security of their traditional crude oil sources, and the development of a significant potential for

serious intermittent crude supply disruptions. These new developments in the oil market resulted from changes in the demand relative to the supply of different types of energy in non-OPEC and OPEC areas. The changes in these demand and supply conditions that occurred during the 1970s caused the prices of all petroleum products to increase. In addition, the increased demand for oil led to an increased dependence on OPEC oil by importing countries. Table 10 shows the 1968 prices for crude oil from various oil-producing areas. American crude oil was highest priced that year. Table 11 lists the acquisition cost of crude for U.S. refiners between 1974 and 1980. It shows that the average acquisition cost of imported crude is greater than the cost of domestic crudes. Figure 3 graphs domestic production and consumption of petroleum products and shows the American economy's growing dependence on imported oil. The potential for supply disruption now depends primarily on the power of OPEC or any of its member countries to control effectively the supply of OPEC oil. Effective control of OPEC oil supply means that a reduction in the amount of oil produced by one member country is not compensated for by an increase by another OPEC country.¹

Many factors contributed to the demand and supply conditions of the 1970s, which in turn generated increasing prices and the dependence on OPEC oil. Increasing prices for all energy resulted from the increasing demand relative to supply for energy during this decade. The increased demand was produced by the strong economic growth of the period, especially in the early years of the decade. Although an increase in the real cost of energy should induce businesses and consumers to convert to more energy efficient methods in their business and

¹The reader can refer to Figure 2 for worldwide production and consumption figures, which show the growing dependence by all importing countries on OPEC oil.

Table 10. PRICES OF DIFFERENT TYPES OF CRUDE, 1968

Country of Origin	Price (Dollars per Barrel)
United States	2.94
Middle East	1.40
North Africa	1.70
Venezuela	1.80
Canada	2.60

Source: *Mineral Facts and Problems*, page 163,
op. cit.

Table 11. U.S. CRUDE ACQUISITION COST, 1976-1980

Date (January 1)	(In Dollars per Barrel)		
	Domestic	Imported	Composite
1974	6.72	9.59	7.46
1975	7.78	12.77	9.48
1976	9.14	13.27	10.76
1977	9.23	14.11	11.64
1978	10.14	14.52	12.13
1979	11.02	15.50	13.11
1980	19.78	30.75	24.81

Source: *Monthly Energy Review*, Department of Energy,
May 1980, page 77.

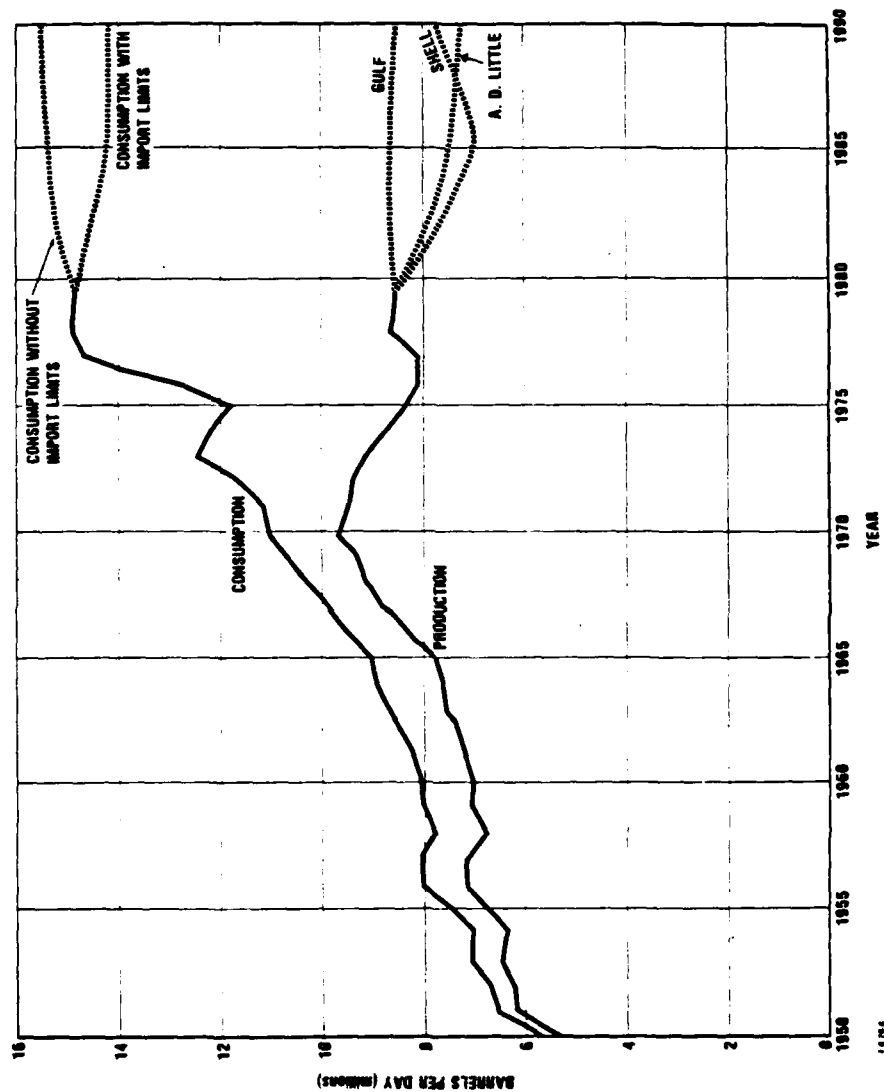


Figure 3. CRUDE OIL PRODUCTION, IMPORTS, AND CONSUMPTION IN THE UNITED STATES, 1950-1979, WITH PROJECTIONS

homes, this conversion takes time and money. The responses to a price increase do not always occur immediately. Consequently, the quantities demanded at all prices (or the demand) in the next period may still increase. Just such a situation existed with the demand for energy in the 1970s.

The factors affecting the supplies of energy produced by importing countries helped to produce both the general increase in energy prices and a growing dependence on OPEC oil. Oil production in oil-importing areas grew slowly, if at all, throughout the 1970s, with the exception of the periods when Alaskan North Slope and North Sea oil came on stream. In addition, a combination of price controls and other government regulations in the U.S. have worked to stifle the development of new sources of both oil and substitute energy supplies for many years.¹

In sum, the dependence on OPEC oil and rising prices were the result of factors that occurred in the decades prior to the 1970s; the 1970s just continued the trend of increasing dependence on OPEC oil. In addition, the ability of OPEC (or a few dominant members) to control OPEC output grew throughout the decade. The Arab oil embargo of 1973 demonstrated dramatically that OPEC production cutbacks would no longer be easily offset by increased production elsewhere in the world. It also demonstrated to OPEC that it could consistently influence the world price for crude oil through concerted efforts to control output.

¹Price controls on interstate sales of natural gas stifled investment in exploration and development of natural gas as a substitute for oil. Phasing out of the depletion allowance and price controls on crude oil reduced incentives to find oil and develop new sources of energy. These are but a few examples of government policy affecting domestic energy industry. The reader can refer to E. Anthony Copp, "Regulating Competition in Oil," *op. cit.*, and H. Steele, "Energy Economics and Policy," *loc. cit.*

The ability to control OPEC output depends in part on the ability of each member to control its own output. Thus, relationships between oil-producing countries and former concessionaires were restructured throughout the decade to give the oil-producing countries greater control over the oil produced. This meant that traditional concessionaires found their secure supplies of crude oil dwindling and more and more OPEC oil was being sold in those markets where major fluctuations in demand relative to supply could produce dramatic increases in the spot price for crude oil.¹ Whether the ability to control OPEC output will continue in the 1980s and be used to extend the trend of rising prices and the threat of possible supply disruption depends upon three conditions. First, importing countries must continue to be dependent on OPEC oil. OPEC's power will be limited if the supply of energy, including substitutes for petroleum-based energy, increases relative to its demand in non-OPEC areas. Second, demand must not decline significantly. Maintaining extremely high prices depends upon a continuing strong demand for oil by importers. However, high oil prices tend to jeopardize the economic growth of oil-importing countries, which in turn could reduce significantly the demand for oil. Finally, OPEC members must achieve enough unity to control output successfully. While the failure of Saudi Arabia to cooperate fully will not necessarily undermine the plan, it will greatly complicate its effective implementation.

In summary, the market environment for crude oil at the close of the decade was characterized by uncertainty concerning supplies of crude oil. Large international refiners faced the possibility of unpredictable disruptions in a significant portion of their supply of crude oil. Small refiners, those

¹See "Shift Seen in World Crude Marketing," *Oil and Gas Journal*, May 5, 1980, pp. 122-124.

dependent upon a third-party sale for the acquisition of crude oil, faced the real possibility of complete loss of crude supplies.

While the events in the market for crude oil were the most important factors affecting the markets for refined products in the 1970s, several other developments affected markets for specific products. First, there was a growth in the final demand for the middle distillates (naphtha, kerosine and fuel oils). The phasing out of leaded gasoline and the growth in the petrochemical industry resulted in a disproportionate increase in the demand for naphtha in the last decade. The expansion of the airline industry in this country, resulting from deregulation, caused a large increase in the demand for kerosine to produce jet fuel. This expansion in the relative demand for the lighter end of the barrel resulted in prices that increased much faster than the prices of the other petroleum products. Table 12 shows the growth in domestic demand for products.

Second, expansion in refining capacity within the United States was very limited during the 1970s. New federal and state regulations all but eliminated the possibility of creating new basic capacity in the refining industry and restricted refining capacity modification to the addition of various forms of downstream capacity. The small refiner bias continued to grow with new programs of the 1970s, such as the crude oil entitlements program and crude oil allocation (buy-sell) program. In 1978, DoE estimated that under the entitlements program, the refiner with capacity under 10,000 barrels per day received approximately a \$2 per barrel benefit as compared to a major refiner.¹ Thus, the 1970s saw the American refining industry concentrating on expanding existing facilities,

¹Department of Energy, "Trends in Refinery Capacity and Utilization," September 1978, page 12.

Table 12. DOMESTIC CONSUMPTION OF PETROLEUM PRODUCTS
(Thousands of Barrels)

Product	1970	1979 ^a	Volume change 1970-1979
Aviation Gasoline	19,903	13,952	- 5,951
Motor Gasoline	2,111,349	2,566,128	+ 454,779
Jet Fuel			
Naphtha	90,927	73,040	- 17,887
Kerosine	262,051	318,610	+ 56,559
Ethane	83,757	128,021	+ 44,264
Liquified Gases	363,059	456,887	+ 93,828
Kerosine	95,974	69,044	- 26,930
Distillate Fuel Oil ^b	927,211	1,207,278	+ 280,067
Residual Fuel Oil	804,288	1,029,913	+ 225,625
Petrochemical Feedstocks	101,183	246,099	+ 144,916
Special Naphthas	31,390	38,363	+ 6,973
Lubricants	49,693	65,315	+ 15,622
Wax	4,607	6,094	+ 1,487
Coke	77,215	89,571	+ 12,356
Asphalt	153,477	169,759	+ 16,282
Road Oil	9,641	3,571	- 6,070
Still Gas for Fuel	163,905	202,286	+ 38,381
Other Miscellaneous Products	14,843	44,647	+ 29,804
Total	5,364,473	6,728,578	+1,364,105

^aPreliminary

^bIncluding #4 Fuel Oil

reactivating older refineries, and investing in desulfurizing equipment and downstream equipment designed to increase the proportion of the barrel turned into gasoline, kerosine and other middle distillates. In fact, only one major grass roots refinery has been built in the U.S. since 1976, although many plants are being expanded.¹ Many of the smaller, straight-still-type refineries, traditionally suppliers of DFSC, have had incentives to invest in this type of capacity. According to the May 19, 1980 *Oil and Gas Journal* construction report, of approximately 105 construction projects listed, over half are for expansions of capacity (including downstream capacity) for refineries with less than 50,000 barrels per day capacity. Many of these projects (over one-third) are for additional reforming capacity.²

Users of the middle distillates found prices for product increasing very rapidly. In addition, periods during which quantities produced domestically were limited, either because of refinery capacity constraints or because of a crude supply disruption, generated particularly severe problems for users of these products. There were periods in the 1970s when those users who wished to expand or maintain their level of use of these products, even at extremely high and rapidly increasing prices, had difficulty finding suppliers.

C. THE 1980s and BEYOND

Given the complexity of the markets for crude oil and refined product, one cannot hope to predict with any accuracy all of the characteristics of the market environment in the years ahead. Nevertheless, there are a few general observations which can be made which would be useful in considering what to

¹ "Refining, Petrochemical Construction in Up Swing," *Oil and Gas Journal*, May 19, 1980.

² *Ibid.*

expect in the market in the near future. First, the increasing relative demand for the lighter ends of the barrel should continue. The particularly high and volatile prices for these products could be damped in the 1980s if the expansion in downstream capacity produces significant increases in the relative supply of the light products from each barrel of crude refined. Such expansion could also lead to increases in the prices of those cuts used in the downstream capacity.

Second, constraints on total refinery capacity in the U.S. could become significant, especially as additional crude supplies resulting from the deregulation of domestic oil prices become available. In the future, one may expect that domestic consumption of refined product will be constrained by the ability of the refining sector to process crude oil. Moreover, as long as state and federal government regulations prohibit the entry of new refining capacity in response to market signals calling for such entry, the capacity constraint will grow more serious.

Third, the phasing out of various small refiner privileges and deregulation of domestic crude oil will eliminate some of the cost advantage small refiners have enjoyed in the past. Small refiners would thus face even greater risk than in earlier decades with the continued exposure to supply disruption, but without the advantages of small refiner biases in regulation. This will have a significant impact on the small refiner segment of the industry.¹

Finally, the continued effort of OPEC to control and direct the world's crude market and to pursue social and political goals as well as economic goals with that market implies that the risk of supply disruption will continue to exist. Of course, OPEC's ability to control price and disrupt supply will tend to be reduced during the decade with the

¹ See "U.S. Refining Capacity Loss Seen From Decontrol," *Oil and Gas Journal*, September 29, 1980.

development of alternative energy sources in the United States and elsewhere in the developed world, or with major new discoveries of crude oil. In addition, a significant worldwide recession (depression) and changing patterns of fuel consumption by users could reduce the demand for crude oil and refined products and limit the cartel's power. Finally, the ability of OPEC to control price and disrupt supply will also depend on its ability to control the output and enforce the cartel's decisions among its own members.

Chapter IV

CAUSES OF DFSC'S PROCUREMENT PROBLEM

Developments in oil markets, as outlined in Chapter III have led to a rapid increase in the prices of all petroleum products in recent years. In addition, the threat to refiners of part or all of the supply of their primary input--crude oil--being removed at any time has increased significantly. In today's markets, such a restriction on a refiner's source of crude oil may occur as the result of a variety of factors. A reduction in the total quantity of OPEC oil available, caused by the coordinated efforts of OPEC members to raise the price of OPEC oil, would affect all refiners that use OPEC oil directly or indirectly. A refiner might also find the amount of crude oil available for purchase affected by any one oil-producing country's efforts to raise its own price by restricting total production, increasing the proportion of its output sold on spot markets or to new customers, or changing various contract terms and conditions. Finally, political or economic disturbances within a country could threaten the flow of crude oil to a refiner.

These changing market conditions have caused the supply of all products, including military products, to decrease relative to demand. Thus, the price DFSC has to pay to purchase any given quantity of products has increased. For all refiners, each element of supply price has risen. Alternate use values have risen because of general increases in market prices or the increased availability of alternative customers. The surcharge and risk components of refiners' supply prices

have also increased significantly in recent years. As a result, DFSC has encountered rising prices and declining amounts offered in response to its solicitations. In 1979, quantities offered fell short of the quantities DFSC requested¹ in DFSC solicitations, producing a "procurement shortfall."

This chapter describes how market conditions affected DFSC's ability to procure desired quantities in the past and how changing conditions affect DFSC's ability to procure the desired quantities in current markets. The historical and analytical descriptions of oil markets in Chapters II and III provide the background information necessary to explain how DFSC contract clauses and procedures are combined with market conditions to determine both the price asked for product and the amount offered to DFSC. Sections A and B describe how each element of a refiner's supply price has changed over the decades.

A. ALTERNATE USE VALUE

During the 1950s and 1960s, the supply of petroleum products increased relative to demand. The result was falling real prices and falling alternate use values for products refined for DFSC. Indeed, for major refiners with established distribution systems, the alternate use value for JP-4 may have been less than the market price for gasoline.² For small refiners and new refiners who had no established distribution systems (or only a few established customers), alternate use values were also low. Selling to DFSC meant that they did not have to compete directly against major refiners in markets for gasoline or kerosine.

¹These requested amounts are referred to as "requirements" by government.

²If the crude oil were refined and marketed as gasoline instead of JP-4, the price for the refiner's gasoline would have had to be lowered. Thus, the net alternative use value for JP-4, as well as other military products, was extremely low.

During the 1970s, demand increased relative to supply, especially for unleaded gasoline, jet kero, and naphtha used by the petrochemical industry--alternate uses for JP-4 and DFSC's kerosine-based jet fuels. In addition, price controls in the early 1970s and in periods when supply was abruptly restricted (the Arab oil embargo and the Iranian crisis) produced periods of excess demand. As a result, refiners, even small refiners, found their markets expanded and alternate use values rising.

Alternate use values of JP-4 were also affected by activities of the Department of Energy (DoE) to encourage the production of unleaded gasoline. DoE's threat to small refiners that continued participation in some of DoE's programs might be withheld unless reforming capacity (to produce unleaded gasoline) were acquired effectively increased the alternate use value of JP-4 (by the amount of the net benefit to the refiner of the program in question).

In summary, refiners' alternate use values for those military products sold to DFSC in the 1950s and 1960s were often less than the market values for alternative products. In the 1970s, periods of excess demand replaced the periods of excess supply. As a result, in the 1970s alternate use values for military products were often as high or higher than actual market prices for comparable civilian products.

Currently there is excess supply in the gasoline market; at least temporarily, alternative use values for JP-4 should be lower than the market prices of component parts. If prices are lowered to eliminate excess supply, the alternate use value for JP-4 will approach the relevant combination of commercial product prices. One would expect, however, that this is a temporary condition. The secular trend of petroleum markets (as opposed to these fluctuations about the trend) should be one of tight supply and rising product prices. Thus, the 1980s

will probably be characterized by more periods of excess demand, during which alternate use values for military products will lie above the alternative commercial product prices.

B. THE COSTS AND RISKS OF DFSC CONTRACTS AND PROCEDURES

Currently, most customers of refiners use contracts written by the refiners; contracting procedures and contract clauses are basically uniform across the industry. DFSC, however, is a major exception to this rule. DFSC contracts are written by DFSC. Moreover, there may be wide variation in the actual content of certain sections of any DFSC contract because refiners may be able to negotiate changes in certain clauses during the contract bargaining process.

This section discusses the impact of changing market conditions on the economic cost and riskiness of a DFSC contract. The elements of a refiner's supply price that are determined by the clauses and procedures involved in negotiating and fulfilling a DFSC contract are: (1) the extra preparation costs; (2) the surcharge or extra contract costs; and (3) the risk premium. These components are added to a refiner's alternate use value to determine supply price.

1. Economic Price Adjustment (EPA) or Price Escalation Clauses

Typical commercial contracts are essentially quantity contracts; prices are not explicitly dealt with in the contract. The official selling price or contract price of the product is changed at the seller's discretion, with the seller notifying the customer of the change in price at least a certain number of days in advance of the next scheduled delivery. Moreover, the terms of payment may be quite limited. Frequently payment is due on presentation of invoice or within a very few days of such a presentation.

DFSC contracts deal exclusively with both price and quantity. Hence, DFSC contracts must contain a mechanism for changing the contract price of the product during the life of the contract. The EPA clauses are the contract clauses that contain the mechanisms for such price adjustments. They determine the actual price received by the refiner for each shipment of product delivered and affect the timing of the full payment for that shipment. In general, the EPA or price escalation provisions of a DFSC contract are very different from those found in the typical commercial contract.

Until quite recently, EPA clause E19.03 was the standard clause offered to refiners (offerors) for domestic procurement.¹ EPA clause E19.03 escalates the contract price of product on the basis of crude acquisition costs. There are several problems with this escalation clause as compared to the price adjustment methods used by civilian commercial customers. First, since the increase in price is based on the refiner's crude costs, if the alternate use value of the product sold to DFSC rises faster than the refiner's cost of crude, this escalation clause prevents the refiner from obtaining the full alternate-use-value component of supply price. This expected difference will then be added to the supply price as part of the risk premium. The rapid rise in prices for the alternate uses for naphtha and kerosine-based jet fuels within contract periods, especially in 1979, did mean that some refiners did not receive the full supply price at the end of the contract period.

Second, if a refiner has to purchase crude oil in the spot market, this clause does not permit a refiner to recover the full cost of acquiring spot crude in order to avoid

¹At the time of publication of the final draft of this study, E19.03 no longer was in use. However, the weaknesses of E19.03 detailed herein would presumably be found in any similar crude-price-based escalation DFSC might develop in the future.

default, unless DFSC in fact purchased the entire barrel from the refiner. Under E19.03, product prices are escalated on the basis of the increased crude cost allocated according to the physical proportion of the barrel sold to DFSC. Thus, if a refiner sold only the top half of the barrel to DFSC, the refiner could allocate only one-half of the incremental cost of crude to the product delivered under the DFSC contract. If the prices for all other products the refiner produced from the spot barrel remained unchanged, the refiner would end up absorbing as a loss one-half of the incremental cost of the spot crude. For a refiner purchasing 10,000 barrels a day on the spot market at a \$10 per barrel premium price, the \$5 per barrel loss amounts to a \$50,000 per day penalty for having a DFSC contract, or 23.8 cents per gallon of product sold to DFSC. Recent market developments have increased the probability that a refiner may have to purchase crude in the spot market and be unable to cover the crude costs. This aspect of the EPA clause, when coupled with the default provision, raises the risk to the refiner of severe financial loss and raises the risk premium of a refiner's supply price.

Third, refiners whose contracts contain E19.03 may have to wait a number of months before they receive full payment for product delivered. While payment of the award (base) price is generally prompt, payment for the additional amounts due resulting from an increase in crude acquisition costs requires a contract modification. Thus, it may take four to six months before a refiner receives full compensation for product delivered. Part of this delay is accounted for by the 30-40 days required to execute a DFSC contract modification. However, a substantial delay also results from the time needed for a refiner to collect all the necessary crude cost documentation, including the DoE-determined value of entitlements, in order to file a contract modification.

Another unique feature of El9.03 is that contract modifications made under this adjustment procedure are temporary; the contract price always reverts to the original base price for the next month's deliveries.¹ Thus, in the next month the refiner is again paid the base price for his deliveries and must again file for another contract modification in order to recover the difference between the original award price and the total amount due for the delivery made in that month. Needless to say, after a year of rapidly rising crude costs, such as 1979, the amounts involved in a contract modification and the interest charges the refiner incurs as a result of the delays in full compensation can be quite substantial.

Problems inherent in El9.03 may be exacerbated by the fact that the base price (award price) is made up of a four-month average of a refiner's most recent crude acquisition costs. It takes approximately two months to accumulate the information necessary to compute the average. The award or base price may thus be as much as three or four months behind the realistic market price for the refiner's product (as determined by crude costs) at the time the award is made. This gap between stated price and effective price for product is not closed until the end of the contract.

In a period of stable crude prices, El9.03 need not create significant financial hardships.² However, in recent years the direct cost to refiners of crude escalation or product price escalation using El9.03 has risen dramatically. This is due to rapidly rising prices combined with higher

¹Subsequent to completion of this study, DFSC has altered this provision of the price adjustment process to reduce the time lag between delivery and full compensation.

²The award price, which is paid promptly, would be essentially the same as the current contract price. Contract modifications would be very small necessary at all. Thus, in the decade of the 1950s and 1960s, contracts containing this clause actually produced a net benefit on some occasions for refiners, since declining crude acquisition (continued on next page)

interest rates. This has caused the surcharge element of refiner supply price to increase.

The following two examples summarized in Table 13 provide an indication of just how significant these interest costs can be, particularly for a small refiner. In the cases displayed in Table 13, DFSC contracts are for two million gallons of refined product per month. It is assumed that: (1) there is an increase of 2 cents per gallon per month in the price of crude purchased by the refiners; (2) there is a four-month lag between the cash purchase of crude and receipt of full payment from DFSC; and (3) the interest rate is 12 percent per year--one percent per month (simple interest). This interest rate represents the amount the refiner must pay to borrow funds to pay for the crude. It also represents the minimum the refiner could earn if the money were put to alternative uses. In Case 1 it is assumed that crude prices did not increase in the six month period prior to the commencement of the contract. Consequently, even though the award price is based on information that is at least four months old, the award price and the contract price effective at the time of the beginning of the contract are the same. Since interest must be paid only on the amounts involved in the contract modifications, in the first month there are no interest charges. In the second month, crude acquisition costs have risen 2 cents per gallon, so the interest charges resulting from the delay in full payment would be \$1,600. In the third month, crude prices have risen by 4 cents per gallon, so the amount of the contract modification would be \$80,000 and the interest charges would be \$3,200. By the end of the year, the refiner will have paid \$105,000 in interest charges, incurred because the cost of acquiring crude must be paid long before full compensation for

(contd) costs sometimes resulted in delayed credit (charged by DFSC) for product delivered.

Table 13. COST OF DFSC CLAUSE E19.03

Month	Interest Charges	
	Case 1	Case 2
1	\$ 0	\$ 6,400
2	1,600	8,000
3	3,200	9,600
4	4,800	11,200
5	6,400	12,800
6	8,000	14,400
7	9,600	16,000
8	11,200	17,600
9	12,800	19,200
10	14,400	20,800
11	16,000	22,400
12	17,600	24,000
Total	<u>\$105,600</u>	<u>\$182,400</u>
<u>Assumptions:</u> (1) Twelve percent rate of interest (one percent per month). (2) Four month lag between cash purchase of crude and final payment. (3) Two million gallons per month contract quantity. (4) Two cents per gallon per month increase in price of crude.		

product delivered is received. This amounts to 44 cents per gallon of product actually delivered.

In Case 2, it is assumed that the acquisition cost of crude increased by 2 cents per gallon per month in each of six months prior to the commencement of the contract. Thus, the award (base) price reflects an average acquisition cost of

crude that is four months out of date at the time of the beginning of the contract. This results in an additional \$6,400 per month in interest charges for the refiner operating with El9.03. The total interest charges incurred as a result of the DFSC contract would be approximately \$182,400 or .76 cents per gallon. If the rate of interest were higher, if the lag between delivery and full payment were longer, if prices rose faster than 2 cents per gallon per month, or if the contract quantities were larger, the dollar cost of El9.03 would be substantially larger.

El9.05 is an alternative to El9.03. El9.05 escalates contract price on the basis of refined product postings. A consequence of El9.05 is that a refiner does not have to wait for months for crude cost information before filing for a contract modification--commercial product posting adjustments are often made in advance of the effective delivery date. Furthermore, the award price would not be based on a four month average of acquisition costs, so the award price should not be significantly out of date at the commencement of the contract. Therefore, a primary source of a surcharge component cost associated with El9.05 would be the interest charges incurred only if DFSC took longer to pay its invoices than did a typical commercial customer.

For many refiners, however, there may be significant disadvantages to using El9.05. If a refiner's crude acquisition costs do not track well with those of a major company and hence, the major company's refined product posting, the refiner could incur significant crude costs that would not be compensated for during the life of the contract. Thus, a small refiner with uncertain crude supplies and with the real possibility of having to purchase a significant portion of his crude supply at "spot market prices" might incur greater economic loss using El9.05 than would be incurred by using El9.03.

Clearly, El9.05 is not a universally acceptable solution to the problems created by DFSC product price escalation clauses.

Finally, the price adjustment clause generates additional risk for a refiner since the clause has a 35 percent ceiling on the amount of price escalation allowed. If the ceiling is reached, negotiations may be undertaken to raise the ceiling. If, however, no agreement on the ceiling is reached, the contract can be terminated by DFSC. Nevertheless, if DFSC wishes to pay for delivery of product at the new (above the ceiling) price, the contractor must "honor orders placed." Thus, in periods of large price increases, reaching the price escalation ceiling offers DFSC the opportunity to terminate the contract at will, but provides no such opportunity to the refiner.

In summary, the rapid and unexpected price increases and the high interest rates of recent years have caused a significant increase in the economic cost and risk of DFSC contracts. The cost of the EPA clause, especially the crude escalation clause, increased the surcharge component primarily because of the interest charges incurred while awaiting full compensation on product delivered. In addition, several elements of the escalation clause serve to increase the risk associated with a DFSC contract. The risk is due to uncertainty concerning the ability to recover all extra crude acquisition costs if spot market purchases have to be made and to obtain the full increase in alternate use values for product that occurs during a contract period. There also exists the risk that after a short period of time DFSC could, if desired, terminate the contract.

In periods of stable prices, these costs and risks are negligible. By the end of the 1970s, they were significant. The numerical examples provide estimates of this cost to the refiner and to DFSC in the form of a surcharge. In the

future the surcharge component associated with this clause will rise and fall with interest rates and prices. The risk premium will rise as the probability of supply disruption rises.

2. Default Provisions

The default provision in the DFSC domestic contract for bulk fuel states that if a refiner is unable to meet his contract obligations and is not excused from these obligations, DFSC must be compensated for the additional cost it incurs in acquiring the lost contract quantities. In addition, the DFSC contract does not have an "allocation clause" that would allow the refiner to place DFSC on allocation in the event the refiner was unable to supply all of his customers with full contract quantities.¹ The default provision of a DFSC contract coupled with the lack of an allocation clause guarantees 100 percent delivery on the part of the refiner.² Increasing uncertainty of crude supplies, particularly for small refiners, has increased the probability that a refiner will be unable to meet 100 percent of the contract obligation and the probability that the refiner will be forced to default or to spend unbudgeted sums to avoid default. In periods when spot market prices for crude oil and for refined product are high, both the cost of attempting to avoid default and the cost of being found in default are high, especially given the nature of DFSC's escalation provisions. Combining the increased probability of an inability to fully perform the contract with the high cost of defaulting on the contract produces a very high risk of financial loss associated with the DFSC contract.

¹Subsequent to the completion of this study, DFSC has obtained approval for the inclusion of a "modified" allocation clause in its standard contract.

²Actually, the contract guarantees that the refiner will either deliver or compensate DFSC for arranging for alternate delivery.

The risk varies according to the refiner's specific crude sources. Instability in Iran, for example, would result in a high risk component for those suppliers dependent on Iranian oil, directly or indirectly. The risk component will tend to be larger, the more dependent a refiner is on foreign crude sources. Also, all other things constant, risk will be lower the greater the number of crude sources a refiner has. For refiners that must purchase crude from large integrated firms, risk will be high, since one would expect the larger refiner to supply its own refining needs and historical distribution outlets first. The small refiner dependent on crude supplies purchased from major oil companies would have a very high, as well as most volatile, risk component of supply price.

The differential impact of a crude supply disruption on different refiners poses an additional problem for contracts that do not contain allocation clauses. In some cases, DFSC could end up paying prices that are higher than what it might have been able to obtain elsewhere. Since the cost of defaulting is so high, there will be periods of disruption when a refiner will purchase crude at spot prices and pass part of this cost through to DFSC in the form of higher prices. However, a lower price from a different supplier whose own crude source was unaffected by the disruption might have been available at that same time. If allocation were allowed, the high priced product and spot purchases of crude by a DFSC supplier could be prevented.

An alternative to default is for DFSC to excuse a refiner from the supply obligations of the contract. By a liberal interpretation of the *force majeure* provision of the default clause, DFSC would be, in effect, allowing a refiner to place DFSC on allocation. Historically, however, the liberal interpretation has not been standard practice. In periods

of significant market disruption, DFSC has, on occasion, excused refiners from delivery obligations for a certain period of time, but has expected that the contract quantities be delivered in full at a later date. That practice may relieve some of the burdens of a DFSC contract in the short run; however, it may create additional problems for a refiner, particularly one with the desire to have an on-going commitment with DFSC. Postponing delivery generally means that the contract is extended over a longer period of time, thus exacerbating the economic problems caused by the price escalation clauses and making future contracts with DFSC more difficult to negotiate. For a small refiner who has contracted to sell DFSC all of the output of a particular cut of the barrel that can be produced by his straight still, it would be impossible to supply against an old DFSC contract while supplying a comparable quantity against a new DFSC contract. Moreover, the fact that DFSC may be flexible in interpreting the contract terms concerning default has little or no bearing on the perceived risk of a DFSC contract. Refiners must consider the contract terms as written when assessing the potential liabilities associated with a DFSC contract.

Both the probability of default and the cost of default have increased from near zero during the 1950s and 1960s to significant levels today. In 1979, the uncertainty of some refiner's crude supplies and high spot prices raised the probability that the refiner could suffer a severe financial loss while fulfilling a DFSC contract. Consequently, the risk premium component to DFSC contracts rose to high levels. The risk premium component was also high relative to what it would be for a commercial customer during this period since commercial contracts typically included allocation provisions.

During the 1950s and 1960s, the risk premium was low or zero for contracts with all customers. Furthermore, commercial

default provisions were similar to DFSC default provisions. Thus, DFSC contracts and commercial contracts were equally risky at least in this one respect. Currently, DFSC contracts must be viewed by refiners as riskier than contracts with commercial customers. Chapter V provides a further analysis of the impact of this clause on DFSC.

3. Clauses and Procedures for Producing and Delivering Products

Producing for DFSC may be more costly than producing for the typical civilian customer. Most product purchased by DFSC have military specifications that differentiate them from the products produced for the civilian sector. Thus, special handling of the military product is required. This may include specialized or segregated storage and transportation facilities. In addition, the refiner may have to reconfigure some of his refining capacity and alter the slate of products obtained in order to fulfill a DFSC contract.

Quality control standards set by a DFSC contract and the procedures required for enforcing those standards increase the cost of doing business with DFSC. It may well be that such standards and procedures are essential to the national defense effort. Nevertheless, it must be recognized that those standards and procedures do impose real costs on the refiners and, therefore, increase the incremental processing cost component of a refiner's supply price.

Delivery procedures for DFSC contracts are often more costly than for civilian contracts, especially when military tankers are involved. Specialty or non-standard equipment on military tankers may create significant problems for refiners. Indeed, at least one refiner felt compelled to purchase his own equipment and supply it to DFSC in order to smooth out the process of tanker loading. In addition, scheduling

changes or lack of appropriate information with regard to schedules has made military deliveries more difficult to plan.

4. Cost or Price Data and Cost Accounting Standards (CAS)

The requirement for the submission of cost or pricing data and compliance with the Cost Accounting Standards (CAS) clauses are two other features of the DFSC contract that distinguish it from civilian commercial contracts. The cost-or-pricing data provisions require a refiner to submit all cost or pricing data which may have a significant effect on costs, including costs of operation, non-recurring costs, unit cost trends, and changes in production methods or volume. Refiners (contractors) feel that the cost or pricing data requested by DFSC are proprietary and that it is inappropriate for a supplier to provide such information to a potential customer. Indeed, no civilian customer would ever presume to demand cost or pricing data from a refiner. Furthermore, the cost of assembling such data and putting the data into a form that would be useful or acceptable to DFSC can be significant, particularly for a small refiner.

Cost Accounting Standards (CAS) are accounting rules set by a five-person Cost Accounting Standards Board. The Cost Accounting Standards were originally devised as a means of controlling the cost allocation behavior of producers of major weapons systems, particularly the hardware associated with those systems. Refiners believe, and there seems to be little disagreement from others, that the Cost Accounting Standards are totally inapplicable to the refining industry.

According to acquisition regulations, both the requirement for cost and pricing data and the CAS requirement can be waived if the contract price negotiated is an "established catalogue or market price of an item sold in substantial quantities to the general public." In addition, the presence

of adequate price competition or the existence of more than one independent responsible offeror would permit DFSC to waive the cost or pricing data requirement for a contractor. In order to qualify for the market exemption for either requirement, however, the refiner must provide sales data for the three months preceding the award of the contract. Since the products typically procured by DFSC are not the same as the products the refiner generally sells to the public, the sales data refiners must submit cover a wide range of refined products. Thus, the compilation of the sales data may be a very time-consuming and expensive effort, particularly for small to intermediate-sized refiners without automated data processing systems. Indeed, even large refiners may not store their sales information in a form needed to satisfy the sales data requirement of DFSC and, therefore, may incur real costs in complying with this DFSC requirement.

Submission of sales data is by itself not enough to earn a market price exemption. The price offered to DFSC by the refiner must fall within the "market range" determined by DFSC on the basis of sales data provided from a number of sources. A market range of wholesale prices by geographic regions is established by DFSC using sales data on "comparable products" supplied by various potential contractors. In general, the market range is set by eliminating the very high and very low prices from the sales data and by using the remaining data to establish a price range where most (perhaps as much as 90 percent) of the sales are made. If the sales data are inadequate (from DFSC's perspective) to permit the accurate determination of a market range, data from other published sources such as the Bureau of Customs, Platts, and the Federal Power Commission are used.

The major problem with the market range is that it does not necessarily reflect the refiner's true supply price. In

periods of rising prices and insecure crude sources, the top of the market range would seriously understate a refiner's supply price for military products for several reasons. First, since the market range is based on prices that refiners *have* charged their civilian customers, the market range is looking backward through time rather than into the future. Refiners typically adjust their posted prices in anticipation of changing market conditions, so that the contract price a refiner would expect to receive from DFSC would be one that was looking forward rather than one that looked back to the "historic price range." Furthermore, since the data supplied would reflect sales to civilian customers, there is no allowance taken in the market range calculation for the surcharge and risk premium components of the refiners' supply prices to DFSC. Finally, since the data are for sales of commercial products, the data provide no information about the true alternate-use-value aspect of the supply price. That is to say, there is no allowance in the market range for costs incurred when the refiner's slate of products causes a change in the composition of the product slate the refiner must sell in the commercial market.

It is important that the market range reflect refiners' true supply prices, or that at least the range applied to a specific refiner or group of refiners reflect that group's supply price. For some refiners, the market range provides information about the probability of obtaining the supply price from DFSC and thus affects the decision to offer product. For many refiners, falling above the market range raises the cost of having a DFSC contract because the refiner must then comply with the cost or pricing data and CAS requirements. In addition, if the contract price agreed upon is above the market range, the refiner may be subjected to the adverse publicity associated with having sold product to the government at an "unfair and unreasonable" or "best obtainable" price.

Such adverse publicity may be unacceptable to a refiner. Thus, the risk premium associated with falling above market range may be large, especially for major refiners. As a result, if the market range does not reflect a refiner's supply price, this will cause both the surcharge and risk components of the supply price to increase.

These clauses have only become relevant for DFSC in recent years. During the 1950s and 1960s, adequate price competition existed. In addition, wage and price controls existed between 1971 and 1974, followed by the mandatory allocation program (Emergency Petroleum Allocation Act). Contract price was determined by the Cost of Living Council during the period of wage and price controls. Under mandatory allocation, DFSC in essence sent out orders for various amounts of products to the refiners. Thus, offers were obtained and the market range represented more of a bargaining tool for DFSC. Naphtha remained under the provisions of EPAA until October 1, 1976. Middle distillates were allocated until February 26, 1979.

Once products were removed from the list of allocable products, suppliers of these products could break existing seller-buyer relationships. The market range concept became important since offers to DFSC declined and the cost or pricing and CAS provisions became relevant. As a result, the market range provided an upper limit to the supply price that DFSC was willing to call "fair and reasonable." In periods of excess demand, such as 1979, the risk and surcharge components of actual supply price, before consideration of cost or pricing data and CAS requirements (but including the surcharge for gathering the sales data), exceeded the upper limit or expected upper limit of the market range.

5. Council on Wage and Price Stability (COWPS) Wage and Price Standards

The clause L195 states that for contracts in excess of \$5 million the contractor must be in compliance with COWPS standards. COWPS, however, will not certify in advance that a contractor or refiner is in compliance. Since this clause provides substantial economic penalties for refiners found to be in "willful" non-compliance, a substantial risk is imposed on contractors by this clause. This clause is a relatively new clause which would cause the risk premium of a refiner's supply price to be larger.

6. Socioeconomic Clauses

There are a number of socioeconomic clauses in a DFSC contract which are not found in contracts with civilian customers. These include clauses associated with equal employment compliance; small, disadvantaged business subcontracting; clean air and clean water provisions, etc., and affect the surcharge component of supply price. These clauses do not affect all refiners in the same way. For some large refiners, particularly those who are forced by other business activities to be in compliance and certify compliance with various socioeconomic provisions, the costs of certifying such compliance to DFSC may be quite small or zero. For other refiners, however, there may be significant staff costs incurred in certifying compliance.

For refiners with on-going relationships with DFSC, the costs associated with these clauses may be "once and for all" costs, except when new socioeconomic clauses are added to the DFSC contract. However, for small refiners without existing DFSC contracts, the cost of complying with the numerous socioeconomic clauses of the DFSC contract may be quite high.

The surcharge component of refiners' supply prices may increase in the near future, depending on the interpretation

of compliance with clause L171, a new clause which deals with a subcontracting plan for small business and small, disadvantaged business concerns. The development of such a plan may be very expensive.¹

7. Other Procedures and Clauses

A number of other clauses or contracting procedures contribute to the riskiness of a DFSC contract. These clauses and procedures may serve to increase the risk component of a refiner's supply price.

First, clauses L8105 and H108 make the DFSC contract effectively a contract for indefinite quantities. That is, the government's obligation to purchase product under the contract is fulfilled once the government has lifted at least 25 percent of the product contracted for with the refiner. In addition, while DFSC "will attempt to lift in approximately equal monthly quantities," DFSC is not required to lift the full amount as stated in the contract or to lift the proportionate amount in any given month. Since special storage facilities and refinery reconfiguration are required in order to supply DFSC, there is a cost associated with possible irregular lifting of product.

Second, DFSC may require a contractor to deliver product up to 30 days after the expiration of the contract. Thus, a refiner may be required to produce and store in anticipation of delivery beyond the end of the effective contract time. Again, when special storage and refinery reconfiguration are required to meet the product terms of the DFSC contract,

¹As long as there is uncertainty concerning how the clause will be interpreted, the uncertainty concerning the range of the possible cost of actually implementing the clause (surcharge component) will be reflected in the risk premium. Once it is known how the plan must be made, the full additional cost is added to the surcharge.

possibility of contract extension may raise the risk of a DFSC contract, especially for a small refiner.

Third, there are several clauses in the standard contract which provide DFSC with essentially costless methods of getting out of the contract when it deems it desirable, but denies the contractor comparable options. One is the 35 percent ceiling on the amount of price escalation allowed in the price adjustment clauses. Another such clause is L36, which states that "with regard to ordered quantities, the Contracting Officer, by written notice, may terminate in full or in part, such orders, when it is in the best interest of the government." This clause allows DFSC to terminate the contract and to be responsible for payment to be made only for the "work already performed." Thus, a refiner may incur significant market opportunity costs in configuring his refinery to supply DFSC and in ordering his contract relationships with commercial customers so as to have the product available for DFSC and yet the refiner has no guarantee of being compensated for those costs. This particular provision may impose a significant burden on refiners, particularly small refiners in a chaotic market environment.

Finally, a contracting procedure which increases the uncertainty involved in dealing with DFSC is the long lead time required for negotiating a DFSC contract. The four to five months between bid offer and notification of award may deprive a refiner of the flexibility needed to survive when faced with unpredictable price changes and uncertain crude supplies. Even for very large refiners, such a long lead time may amount to more than a nuisance. In periods when there is uncertainty as to crude supplies or market prices, one would expect that the long lead time would raise the risk of negotiating a DFSC contract.

8. Estimate of Extra Cost and Risk of DFSC Contracts

The actual extra costs of supplying DFSC as compared to a civilian commercial customer is the sum of the last three components of a refiner's supply price: the extra processing cost, the surcharge, and the risk premium. The actual amounts will differ, since refiners negotiate different contract clauses and face different conditions. Thus, it would be difficult if not impossible to attempt to measure these components of supply price. However, a few numerical examples in the preceding sections have shown the magnitudes of some of the clauses. In addition, discussions with many companies reveal that for some major companies, the cost of complying with the existing socioeconomic clauses is essentially zero. On the other hand, the cost of complying with the new clause concerning the submission of a minority subcontracting plan would have an initial cost of tens of thousands of dollars. It has been suggested that the sum of the last three components of the refiner's supply price would be somewhere between a fraction of a percent and ten percent, and higher for some smaller refiners.

Chapter V

DIRECT ACQUISITION OF PRODUCT: ALLOCATION

This chapter analyzes the possible impact of allowing an allocation clause in DFSC contracts.¹ As described in the preceding chapter, civilian commercial contracts allow a refiner to allocate his customers in the event of a disruption of the refiner's crude supply. Supply contracts for DFSC's Bulk Fuels Division do not contain such an option. As a result, DFSC is a riskier customer than other customers, and there is a risk premium component of the refiner's supply price to DFSC. Furthermore, for many refiners, this risk premium component of DFSC contracts has increased dramatically in recent periods for many refiners, reflecting the increased instability of crude oil supplies from OPEC members.

If DFSC contracts contained an allocation clause, the risk premium component of the refiner's supply price should be lower and DFSC should thus pay a lower contract price for product. Moreover, for any supply price, the inclusion of an allocation clause should mean that the quantity of product offered to DFSC at any given price would be greater. On the other hand, the inclusion of an allocation clause in the DFSC contract could mean that DFSC would be placed on allocation by one or more of its suppliers during the contract period. Thus, the quantity of product actually delivered to DFSC during the contract period could be less than the quantity contracted for at the beginning of the period. Thus, the

¹After this draft study was written, a modified version of an allocation clause was added to contracts in the Bulk Fuels Division.

analysis of including or excluding an allocation clause in DFSC contracts is not as straightforward as the analysis of other contract clauses.

In this chapter we describe how DFSC might evaluate the advantages and disadvantages of an allocation clause. Section A describes the risk premium associated with not allowing an allocation. Section B compares the cost of DFSC contracts with and without allocation when it is assumed that the price DFSC can pay is not limited by budget or other institutional constraints. Section C describes the impact when the price DFSC can pay is limited.

A. THE RISK PREMIUM FOR NOT ALLOWING ALLOCATION

As described in Chapter IV (A.2.), from the refiner's perspective a contract without an allocation clause is riskier than a contract containing such a clause. As a result, the price of products sold under no-allocation contracts will contain a premium reflecting this risk. The size of the risk premium, R , will vary greatly among refiners and over time depending upon a number of factors including: (1) a refiner's view of the probability of a supply disruption occurring during the contract period; (2) the possible impact of a supply disruption on the refiner's crude supply; (3) the cost of providing full contract quantities to customers in the event of a supply disruption; and (4) the ability of the refiner to recover the extra cost of supplying the product during the disruption from his customers. In general, the more uncertain a refiner's crude supply or the more uncertain crude markets are in general, the higher R will have to be to induce a refiner to offer product to DFSC under no-allocation contracts. If refiners feel that there is only a small chance of market disruptions occurring during the contract period, the risk premium associated with such a contract could be low.

If conditions change, so that the probability of a supply disruption occurring during the next contract period increases, the risk premium component of the supply price would also increase.

B. COMPARISON OF NO-ALLOCATION CONTRACTS WITH ALLOCATION CONTRACTS

Section 1 compares the cost to DFSC of obtaining the desired quantities of petroleum products (1) using contracts that allow allocation and (2) using contracts that do not allow the refiner to place DFSC on allocation. Section 2 provides some insights into how DFSC might estimate the costs of the alternatives.

1. Analysis of Alternatives

In order to compare the cost to DFSC of obtaining the desired quantities of petroleum products with or without an allocation clause in contracts, four assumptions are made: (1) the price DFSC can pay for product is not limited by either institutional restraints on price or a budget limit; (2) DFSC wishes to obtain a quantity, Q^* , of one product such as JP-4;¹ and (3) before the solicitation period begins, DFSC chooses either to include an allocation clause in all contracts (alternative A) or to exclude the allocation clause (alternative NA) from all contracts. Once that choice is made, all contracts are the same; and (4) default for other reasons such as fire, accident, etc. does not occur.

If DFSC chooses alternative NA (allocation not allowed), the unit supply price of the product will be larger than the price under alternative A (allocation allowed) by the amount of

¹Since refining is a process whereby quantities of product can be produced almost immediately, we do not complicate the analyses with concerns over variations in the flow of product over the period.

the risk premium R . DFSC may view the total cost of not permitting allocation as the cost of insuring that a specified quantity will definitely be delivered. This cost is obtained by multiplying the total contracted quantity by the risk premium, i.e., RQ^* :

$$\text{Cost of not allowing allocation} = RQ^* . \quad (1)$$

On the other hand, if DFSC chooses alternative A (allocation allowed) it would not pay this risk insurance. However, the amount of product DFSC actually receives depends on whether or not refiners place DFSC on allocation during the contract period. Suppose DFSC is placed on allocation by one or more refiners so that it has an α percent shortfall during the contract period.¹ That is, quantity actually delivered is less than the desired Q^* by the amount αQ^* . This amount must therefore be purchased at spot prices on the open market. If D is the difference between the spot price and the contract price, then the extra total cost of purchasing at spot prices is equal to:

$$\text{Cost of allocation clause} = D\alpha Q^* , \quad (2)$$

where D is the premium for buying at spot prices and αQ^* is the amount that would have to be purchased at spot prices. $D\alpha Q^*$ can be viewed as the cost of an allocation clause.

The cost of not allowing allocation (equation 1), can be compared with the cost of allowing allocation (equation 2). The cost of obtaining Q^* using either alternative would be the same when

¹ It is assumed that the disruption, if it does occur, comes at the beginning of the contract period and lasts throughout the period. In reality, a disruption could occur at any time during the contract period. Since it is assumed that DFSC can pay a high enough price to fill a shortfall quickly, the timing of the shortfall need not be considered.

$$RQ^* = D\alpha Q^* \text{ or } R = D\alpha . \quad (3)$$

When R is greater than $D\alpha$, the alternative of not permitting allocation is more costly. When $D\alpha$ is greater than R , then alternative A is more costly. These relationships can be summarized below:

Choose NA if $R > D\alpha$,

Choose A if $R < D\alpha$.

DFSC must choose between alternative NA and alternative A before the contract period begins without complete information about the relevant variables. Thus, DFSC must estimate the values α , D , and R before a cost comparison can be made. These expected values for R , D and α will vary from period to period depending upon the state of the petroleum market.

2. Estimates of R , D and α

This section describes how DFSC might estimate values for the variables R , D and α . In addition, cost comparisons of the alternatives are made for hypothetical values of R , D and α .

Past experience can be used to generate some possible values for R , D and α . First, consider possible values for α , the proportion of desired quantities that DFSC would have to purchase at spot prices because DFSC was placed on allocation by one or more refiners. In late 1979, even though many refiners faced supply curtailments, many major oil companies did not have to place their customers on allocation; others delivered somewhere between 80 and 100 percent of contract quantities to their customers. The proportion of contract quantities that DFSC would receive in the event of a supply

cutoff would depend on the source of the disruption, the number of DFSC suppliers who were affected by the disruption, and the contract quantities of these suppliers relative to DFSC's total contract quantity, Q^* . However, the experience of civilian customers during late 1979 would indicate that even during a severe supply crisis, buyers of product would probably not be allocated to quantities less than 80 percent of contract quantities. Indeed, if a crisis did arise so that *average* allocation percentages were to drop to as low as 80 percent on all domestic refiners, then it is likely that the government would act to allocate energy supplies.

If DFSC were allocated to 80 percent of total contract quantities, this implies an α of 20 percent. Thus, one might expect that for DFSC α would range between 0 and .20.

One can also use historical information to obtain estimates for D , the difference between spot price and contract price for any petroleum product. This information may not be as easy to document for DFSC since DFSC buys military products. However, some feel for the difference may be obtained from the experience of commercial customers. For example, some commercial airline companies were paying up to 25 cents per gallon over contract price for kerosine-based jet fuel during the 1979 supply curtailment. This can be viewed as an upper range for D , although it is clear that D would vary depending on the product purchased and the severity of the supply cutoff.

The risk premium that DFSC would have to pay for having a riskier contract, R , is the variable that would be most difficult to estimate. As described in Section A of this chapter, R depends on the refiner's views on oil market conditions and the impact of a possible supply disruption on his ability to meet DFSC contract quantities. Thus, R would vary widely depending on the individual refiner's sources of supply and the possibility of supply cutoff.

One can use historical information to establish possible ranges for α and D and to generate estimates of the cost of the allocation clause $D\alpha$. These values would then identify a critical value for R. If R is greater than $D\alpha$, then the cost of not allowing allocation would exceed the cost of the allocation clause. Values for R below $D\alpha$ would imply that not allowing allocation would be more cost effective. Table 14 presents values for $D\alpha$ for hypothetical values for D and α .

Table 14. VALUES FOR $D\alpha$

Proportion of Contract Quantities DFSC Must Purchase at Spot Prices, α , in percent	Values for $D\alpha$ or Critical Value for R			
	.10	.20	.30	.40
05	.005	.010	.015	.020
10	.010	.020	.030	.040
15	.015	.030	.045	.060
20	.020	.040	.060	.080

According to the above table, if DFSC has to purchase 20 percent of desired quantities on the spot market and if spot prices are \$.30 per gallon above contract prices during a severe supply disruption, then $D\alpha$ would be equal to \$.06 per gallon. If R is less than \$.06 cents per gallon then alternative NA is cheaper than alternative A.

In periods of good information, one would expect market prices to cause R and the spot premium to adjust, so that the expected cost of using either alternative would converge. The expected cost of alternative NA would tend to be higher, reflecting benefit to the customer of the risk insurance purchased. That is, the customer benefits from knowing that 100 percent of contract quantities will be delivered. In addition, the

customer benefits from not having to enter the spot market and arrange purchases in a time of shortfall.

However, the petroleum markets in the 1970s were characterized by periods of extreme uncertainty. During these periods, the expected costs of using either alternative probably did not converge. Industry's wide-spread adoption of allocation clauses in contracts indicates that the cost of no-allocation contracts may outweigh the benefits significantly.¹

In summary, DFSC can guarantee delivery of the desired amount of product Q* by not allowing allocation as long as DFSC is willing and able to pay the full supply price for product. However, there is a cost of guaranteeing delivery in this fashion. This cost of not allowing allocation appears to be significant, as indicated by industry's use of allocation clauses. In addition, the price DFSC would pay for product would vary from period-to-period as the risk premium changed. Clearly, the risk premium could fluctuate widely, making budget planning difficult for users of product.

C. UPPER LIMIT ON PRICE DFSC CAN PAY

The analysis presented above assumed that DFSC was able to pay whatever R was acquired to enable it to obtain Q* with alternative NA. However, if DFSC were unable to pay more than a certain price because of direct limits on price or on the procurement budget, or if refiners thought that they would be unable to obtain their supply price from DFSC, DFSC

¹Contracts allowing allocation were adopted in commercial contracts even though some industries have small inventory capacity and little flexibility in reducing the use of products. For example, airlines are committed to flight schedules and have only a few days of inventory capacity—basically what is stored in aircraft fuel tanks. Thus, airlines have little flexibility in being able to reduce the amounts they procure during a supply disruption.

could be unable to procure Q* using alternative NA. In such a situation, the lower the price DFSC was able to pay or the higher the average R for refiners, the smaller the amount offered to DFSC would be. Thus, in this situation, DFSC could face a procurement shortfall at the close of the solicitation period using alternative NA. In that case, DFSC would be effectively placed on an allocation before the contract period began. That shortfall would have to be made up by purchases at premium prices. If the premium could not be paid, inventories would have to be used or military use of products curtailed.

The amount DFSC is able to obtain using no-allocation contracts would vary from period-to-period depending on (1) the refiner's risk premium and (2) the price DFSC can pay. In periods of surplus or relatively stable markets, such as the spring of 1980, DFSC may be able to procure Q* using alternative NA. In other periods, the shortfall could be very large, indeed, larger than the shortfall DFSC would have faced had it been placed on allocation. This latter situation occurred during 1979.

D. SUMMARY

DFSC can insure against a shortfall other than those arising from accidents or acts of God if DFSC is always able to pay "a high enough price." However, since DFSC could be unable to pay an average risk premium that would be high enough to insure itself against a procurement shortfall under all market conditions, significant procurement shortfalls could still occur. Thus, DFSC could end up paying more to procure Q* under no-allocation contracts and still have a large procurement shortfall, as in 1979. Even if DFSC were always able to pay a high enough price to be able to obtain Q* by using no-allocation contracts, alternative A would be preferred because of the higher cost of alternative NA.

Chapter VI

INDIRECT ACQUISITION OF PRODUCT

This chapter considers the factors influencing the supply price of refined product procured using an indirect acquisition method. Section A examines the acquisition of crude from foreign sources by barter or purchase, with the transformation of that crude into refined product by either processing agreements or crude-for-product swaps. Section B considers supply factors inherent in the domestic acquisition of crude oil and the transformation of that crude into refined product.

A. FOREIGN ACQUISITION

This section addresses issues that should be analyzed when evaluating the desirability of attempting to acquire refined product by acquiring foreign crude or refined product through barter or purchase and the transformation of the crude into product. Section 1 discusses exchanging goods for crude oil or refined product--barter. Section 2 analyzes the impact of the purchase of foreign crude oil on DFSC's supply of refined product.

1. Barter

The economic foundation of barter (goods-for-crude or product swaps) is the coincidence of wants. The successful culmination of a barter transaction requires that at least three conditions be met: (1) both parties must have something that the other party is interested in obtaining; (2) the terms of trade (the relative price of the goods or products being

traded) must be acceptable to both parties; and (3) it must be possible for both parties actually to make the transaction in question. Presented below is a brief discussion of barter as a means of obtaining crude oil or refined product. The discussion considers each of the three requirements for a successful barter transaction as they apply to the trading of nonrestricted or commercially traded goods and as they apply to the trading of restricted goods--commodities not easily obtainable on the world market.

When trading nonrestricted goods for crude oil or product, the coincidence of wants and the acceptability of terms of trade are essentially inseparable. The country possessing the oil must be willing to trade that oil for a good that can be supplied by the country or company desiring the oil. In addition, the price at which the oil is sold (the terms of trade relative to the good being bartered) must be such that the country supplying the oil gains a net advantage by using barter rather than using transactions on the open market. In other words, an oil-producing country would be interested in barter only if it could obtain more bushels of wheat per barrel of oil by barter than by selling the oil outright and purchasing wheat. For the oil-buying country, this would mean a higher effective price for oil obtained by barter rather than by transactions on the open market. Moreover, since transaction costs associated with barter tend to be higher than transactions costs associated with use of hard currency, the net cost of oil obtained by barter would be higher than the net cost of crude oil purchased with acceptable foreign exchange.

The absence of barter as a technique for procuring crude in the world market confirms the assertion that the acquisition of crude oil using dollars (or other foreign exchange) is more efficient than the acquisition of oil using wheat or other nonrestricted products. If oil-producing countries

were really interested in trading crude for nonrestricted products, or if companies or countries were willing to pay a *de facto* premium to purchase crude, we should have observed such goods-for-crude swaps during the recent period of crude stringency. In fact, the only deals we observed in the international market for crude were deals involving premiums paid in technology or other intangible items (items not readily valued on the world market or not readily available as fungible commodities on the world market) as part of an overall crude purchase contract.

The third requirement for a successful barter exchange is particularly relevant to DFSC. Even though a non-strategic or commercially available good may be freely traded in world markets and may be a fungible commodity (easily exchangeable in quantity and kind for other units of the same commodity), if foreign policy or strategic considerations restricted the ability of the DFSC or any other agency of the federal government to trade that commodity, DFSC could be unable to consummate a barter transaction (even if the barter transaction met the coincidence of wants and acceptability of terms of trade criteria). In other words, a company with foreign subsidiaries could plan to consummate a wheat-for-crude exchange on a regular basis more easily or with greater certainty than could DFSC. The policy transactions costs to DFSC of attempting to trade goods, which might at one time or another be restricted for reasons of foreign policy, for crude or refined product would further complicate DFSC's ability to fulfill its mission. Instead of gaining "supply assuredness," DFSC could find itself in a position of increased supply stringency at some crucial point in time when the commodities involved in the barter process were deemed to be more important as tools of foreign policy than as a method of obtaining crude or refined product.

The exchange of strategic or restricted products for crude may create a slightly different set of problems. Clearly, such an exchange requires a coincidence of wants. However, the terms of trade issue changes slightly. The supplier of the restricted commodity might have more bargaining power in determining acceptable terms of trade. Indeed, the exchange of a restricted commodity for crude approaches something of a bilateral monopoly negotiating process. However, to the extent that a "substitute" may be available from an alternative source (such as war planes purchasable from France or from the Soviet Union as opposed to the United States), there would be limits on the terms of trade that could be negotiated.

The ability to consummate a transaction is a more important consideration for exchanges involving restricted commodities than for those involving unrestricted commodities. One would expect that it would be difficult for DFSC to make on-going barter agreements with strategic or restricted commodities. DFSC would presumably have to include numerous parties (within the federal government) in its negotiation with a supplier of crude or product in order to be able to guarantee the consummation of the transaction. Furthermore, the party supplying the oil would know that the transaction could be interrupted or cancelled at almost any point by Congressional or executive whim. On the other hand, because the transaction would involve strategic or restricted items, the oil-supplying country would be vulnerable to internal as well as international pressure.

In summary, barter is a less efficient method of acquiring crude oil or refined products. Moreover, using restricted commodities to barter for petroleum products could reduce DFSC's supply flexibility and increase its and DoD's vulnerability to serious procurement problems that could be totally beyond the control of DFSC.

2. Acquiring Foreign Crude Oil and Transforming It Into Product

The following discussion analyzes two issues. First, do the procurement options involving the acquisition of crude oil (indirect procurement) increase the amount of product actually delivered to military users? Second, can DFSC acquire the product using indirect procurement at a lower unit cost than if the same amount were procured directly from refiners?

Should DFSC expect to be able to use the acquisition of foreign crude oil to create a supply of product that is as secure as or more secure than the supply of product acquirable by a contract with a major refiner? The answer to that question is no. First, a contract to acquire crude from a foreign producer would be a contract with a foreign government. As such, the contract would be as good as, but no better than, the foreign government's desire to honor that contract. A change in government could leave DFSC without its crude source and, therefore, without a supply of refined product. Moreover, crude oil clearly labeled as the supply of the Department of Defense of the United States would be more vulnerable to disruption for political reasons. In addition to the possible causes for crude supply disruptions mentioned above, there exists the possibility of lost crude due to accidents or other acts of God. Thus, foreign crude oil obtained by DFSC would not necessarily be secure.

When comparing crude acquisition with the option of acquiring final product from a major refiner, two other points are relevant. First, security of supply depends primarily on the security of the DFSC crude oil source as compared with the sources of the refiner. Holding everything else constant, flows of refined product are more secure when obtained from a refiner with a larger number of sources. Second, DFSC would bear the risk of ownership of oil, and as owner, would bear the

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whole brunt of any event (disruption, accident, etc.) that affected the owned crude oil. On the other hand, if DFSC purchased refined product from a major refiner, DFSC would have security inherent in a diversified portfolio of crude sources. A disruption in one crude source would result in only limited reduction in refined product deliveries, if there were any reduction at all. Since DFSC would not own the crude, the direct consequences of any accident or disruption in supply would be borne by all customers of the oil company equitably, rather than by DFSC alone.

The next issue concerns the cost of the product obtained by indirect means. There are two parts to this question. First, can DFSC expect to acquire crude from a foreign source at a price that would make the final product obtained competitive with the product acquired on contract from a major refiner? Second, regardless of initial crude costs, can DFSC transform the foreign crude into refined product for a lower price than the price of final product procured directly?

First, it is not likely that DFSC would be able to consistently acquire foreign crude at a price lower than the price paid by a major international oil company. While, on some occasions, especially in a surplus market, DFSC might be able to make some purchases at prices below marginal contract prices, over a long period of time, DFSC could not expect to get foreign crude at a lower price. In a crude-tight period, it is possible that DFSC would be charged a high marginal price by a foreign company to avoid internal political criticism. In addition, in a tight market as today, many foreign producers are requiring premiums for the right to enter the buying queue or placing restrictions on contracts. Table 15 presents examples of contract restrictions. If the premium required is a "dollar" premium, DFSC might pay that premium if it were willing to accept the implications of such a

Table 15. CONTRACT RESTRICTIONS BY OIL EXPORTERS

Country	Exchange resale	Transportation	Explo-ration	Processing	Signature bonus (spot/premium)	Advance payment	Tech-nology capital	Political
Abu Dhabi	X	X		X				X
Algeria	X		X					X
Indonesia			X					
Iran	X			X	X			X
Iraq	X	X			X	X		X
Kuwait*	X	X		X	X			X
Libya	X		X				X	X
Mexico	X						X	
Nigeria	X	X			X			X
Norway		X						
Qatar	X							
Saudi Arabia	X	X		X				X
Venezuela	X						X	

*Crude substitution, bunkering

Source: Department of Energy as reported in *Oil and Gas Journal*, "Shift Seen in World Crude Marketing," May 5, 1980, Page 123.

premium for the final cost of crude and product acquired. However, if the premium were in terms of technology or technological assistance to be rendered or in terms of political support for an international issue, DFSC could find itself unable to pay the premium.

The discussion that follows examines factors that could influence the cost of transforming crude oil into final product. First, one must address the issue of the refiner's charge for product transformation. In interviews with employees of a number of major oil companies, we found the expressed consensus to be that "processing charges" assessed by a refiner would be no less than those charges necessary to assure that the product produced would not be used to undersell the processor in the relevant market. That, however, would be the minimum price charged for a processing agreement. Indeed, in the final analysis, processing agreements would be based on an assessment of "what the market would bear." Thus, the general observation is that DFSC would, on average, pay a processing charge at least as great as the processing charge implicit in the price of final product being sold by the same refiner internationally.

In addition, unless DFSC were able to use the entire slate of products refined from DFSC's crude oil, DFSC would have to bear the risk and transactions costs associated with disposing of those portions of the barrel not used by DFSC. Shifting the risk or transactions burden to the refiner would result in an increase in the fee charged to DFSC. Thus, DFSC would pay for the risk bearing whether or not the risk were borne directly by DFSC or indirectly through an agreement with a refiner.

Finally, any option for obtaining refined product using processing agreements would likely increase the number of transactions required to supply DFSC. As the number of transactions increased, so would the cost of making these transactions.

The economic analysis of a crude-for-product swap is essentially the same as that of barter. In this case, DFSC would be bartering or trading to obtain refined product using crude oil as the medium of exchange. The internal economics of the crude-for-product swap would be the same as the internal economics of any other commodity-for-refined product swap, except that there may be certain transactions costs, such as transportation to a usable refinery or the cost of swapping one crude type for another, associated with crude-for-product swaps that would not be associated with a straight commodity-for-product-or-crude barter with a foreign government. In order for DFSC to do better with a crude-for-product swap than DFSC could do by spending dollars or other foreign exchange to buy product, DFSC would have to have access to a very special barrel of crude. Otherwise, the spot sale of crude and the use of the revenue so generated for the purchase of product should provide DFSC with refined product at a price as low as or lower than the price implicit in the crude-for-product swap. To the extent that DFSC, as a government agency, is less capable of engaging in a number of international oil transactions than would a major oil company, the implicit cost of product acquired by a crude-for-product swap may be greater than the cost of product acquired through traditional procurement channels.

B. ACQUISITION OF DOMESTIC CRUDE

In theory, the government could attempt to acquire crude domestically from any one of a number of sources. We will assume, however, that the political considerations in a peacetime environment would rule out the possibility of DFSC acquiring crude from sources other than government-owned or government-controlled crude such as the Elk Hills Naval Petroleum Reserve or the outer continental shelf royalty oil. If DFSC were able to acquire domestic crude, this would provide DFSC with a secure source of crude oil which could be traded for

product. Such supplies of crude oil could be an advantage to DFSC during crude-tight periods. However, the cost of these sources of crude is close to the spot market price.

There are other issues involved in the transformation of domestic crude once it is acquired that should be considered. First, the same drawbacks for processing agreements that would be encountered in international markets will be present in a domestic processing agreement. A domestic refiner will avoid creating a competitor when processing someone else's crude.

Second, if a domestic refiner must process and deliver a slate of products different from the natural yield of the crude, the implicit price of the product delivered would tend to be higher than the contract market price for that product. Furthermore, if DFSC were attempting to circumvent a general stringency with respect to a particular cut of the barrel, a refiner may be reluctant to commit that cut from barrels which would normally go into his standard distribution channel to DFSC. This would be particularly true when the market for the desired cut was strong, while the markets for some of the other cuts of the barrel were weak. Such has been the case in a number of periods in recent years.

A logistical problem that is common to both the processing agreement and the crude-for-product swap when domestic crude is involved (particularly California crude) is the problem of getting the acquired crude to the desired refiner. Except for a small quantity of California crude that may leave via the Four Corners pipeline, crude oil produced in California is refined in California. Much of the relatively high gravity Elk Hills crude oil is currently being refined by small local refiners since the larger refineries have the capability of refining much lower gravity crude oil.¹ Thus, attempting to

¹The importance of Elk Hills oil to small refiners is stated in the Statement of Douglas M. Johnson, President, Sabre Refining, (continued next page)

trade Elk Hills crude oil for product to be delivered outside California could be costly or could require the cooperation of a handful of major refiners. DFSC could find itself with crude oil in California and with available refiners who might or might not be capable of meeting DFSC's requirements for product. In addition, product produced in California would have to be used in the California area, or DFSC would incur transportation costs of moving that product to different areas. Finally, if the crude were actually moved out of California, this would mean a reduction in the amount available for local refiners and could lead to a reduction in the amount of final product offered by California refiners.

One major feature distinguishes the crude-for-product swap from the processing agreement in the domestic market. Strictly speaking, with a processing agreement, DFSC would have the exclusive responsibility for moving crude from the point of acquisition to the point of processing and, in theory, would retain title to that crude throughout the entire process.¹ With the crude-for-product swap, the title to the crude would be transferred at some point in time to the refiner supplying the product. There are, therefore, two potential advantages to the crude-for-product swap over the processing agreement. First, from the perspective of the refiner, the crude-for-product swap takes DFSC's name off the crude at a very early stage. This would permit the refiner to use the crude in whatever way he deemed appropriate, subject to the constraint

(contd) Incorporated, on behalf of the Independent Refiners' Association of California, before the U.S. House of Representatives Committee on Interstate and Foreign Commerce Subcommittee on Energy and Power, relating to the use of Naval Petroleum Reserve Crude Oil and the Strategic Petroleum Reserve, Washington, D.C., 21 May 1980.

¹In fact, there are a variety of types of processing agreements, and DFSC can relinquish title at any stage in the refining process, depending on the agreement made. For purposes of discussion, a strict definition of processing agreement is used to differentiate it from the crude-for-product swap agreement.

that the refiner must deliver to DFSC the contracted for quantities at some point in time. On the other hand, the processing agreement would put a larger accounting burden on the refiner, especially a supplier with a complex refinery.

The second advantage is that from DFSC's perspective, the crude-for-product swap places the burden of moving the crude and making the appropriate use of that crude squarely on the refiner. Whenever DFSC relinquishes title to the crude, the risks become the refiner's rather than DFSC's.

In summary, obtaining refined petroleum product by acquiring and transforming domestic crude will, on average, cost more than product obtained directly from domestic refiners.

C. CONCLUSIONS

There are some conditions under which indirect acquisition of petroleum products could result in a lower price and more secure supply. However, on average, prices would tend to be higher. The security of supply and demand vary according to the sources of crude oil. Domestic sources tend to be more secure than foreign sources, and a larger number of sources tend to result in more secure product supplies.

It should be noted that many of the comments made are also applicable to the government ownership of refinery capacity or any other stage of the refining process. In general, the unit cost and risk of reduced deliveries both will be greater when crude is acquired than when final product is obtained directly from a refiner.

Chapter VII

PROPOSED SOLUTIONS TO DFSC'S PROCUREMENT PROBLEMS

DFSC's basic objective is to procure supplies of refined petroleum products adequate to meet the peacetime requirements of the Department of Defense given the budget restrictions placed on it by the various services. The basic procurement problem faced today by DFSC is that of "needing" to buy more refined product than they can buy either because of budget constraints or because of institutional limits of the price they can pay. Solving DFSC's procurement problem means reducing the price DFSC must pay to a level that would permit DFSC to procure those adequate supplies without violating either the budget constraint or encountering the institutional barriers to paying the appropriate supply price. The issue is not adequate supply, *per se*, or "supply assurance," but DFSC's ability to pay the supply price. Clearly, whatever action DFSC takes should be directed at reducing the price they must pay in order to acquire refined product.

Before proceeding to review the remedial actions proposed in this study, a few general caveats are in order. First, we assume that DFSC must behave as though it had no power to affect directly the budgetary restrictions placed upon its actions. It may well be that in the future DFSC must take actions to improve its ability to influence the nature of the budget restriction that it faces; however, such considerations cannot be dealt with in this study. Second, it should be noted that there may be certain circumstances under which DFSC would be unable to acquire adequate supplies of refined

product, even if DFSC were "able" to pay the refiners' supply prices. One can conceive of situations where Congress would decide that limited quantities of fuel available within the United States should be rationed in such a way that sufficient supplies to meet DFSC's needs would not be available for defense purposes. However, for the purposes of this study, we set aside the possibility of such institutional interferences with DFSC's participation in the marketplace.

Finally, proposed actions discussed in this chapter focus on DFSC's ability to perform its mission in a peacetime environment with an orderly functioning market. We assume that major market disruptions caused either by economic or political crises would be dealt with either by Congressional or administrative actions. The Defense Production Act (DPA), the Emergency Petroleum Allocation Act (EPAA), or some other action would be taken to ensure that the Department of Defense or other competing segments of the economy were able to acquire refined petroleum product. Our concern here is with DFSC's ability to procure adequate supplies of refined product for the Department of Defense when there is no clear pressure on Congress or the executive branch of the government to interfere with the normal functioning of the marketplace.

In summary, DFSC's efforts to improve the performance of its mission should be directed toward reducing the supply price of the product in the marketplace. The remainder of this chapter presents an analysis of alternative actions DFSC can take to facilitate the successful performance of its mission. Section A discusses actions DFSC and other agencies might take to improve DFSC's performance of its mission through the direct acquisition of refined products. The options considered focus on actions DFSC can take to reduce one or more of the components of the refiner's supply price, and, thus, increase the quantity of product DFSC can acquire

in any given budget period. Section B summarizes alternative approaches to achieving DFSC's objective through the indirect acquisition of refined products. These options involve DFSC acquiring crude oil and having it refined into the desired products.

A. LOWERING THE SUPPLY PRICE ON REFINED PRODUCT

The options considered below are organized in terms of the basic DFSC or other agency action affected. Clearly, some actions will influence more than one component of supply price. Those situations are noted in the text.

1. Price Escalation Provisions

An obvious place to begin the attack on the supply price of the refiner is by restructuring the price escalation provisions of the DFSC contract.¹ There are two different aspects of the price escalation provisions which should be considered. First, DFSC should endeavor to reduce the length of time required for a refiner to receive full payment under the price escalation provisions, regardless of how the value of full payment is calculated. For example, DFSC could assure that in all contracts the price modifications executed in period 1 continue into period 2, rather than requiring that the contract price always revert to the base or award price. Any effort in this direction will work to reduce the interest charges which may be incurred by a refiner as a result of a delay in full payment and thus reduce the surcharge component of supply price.²

¹Subsequent to the completion of this study, DFSC has taken steps to reduce the time gap between delivery and full payment, and to alter the manner in which payment price adjustments are calculated.

²In periods of surplus due to short-term deviation or a change in the trend any delayed payment will cost DFSC rather than the refiner.

Second, DFSC should take steps to change the structure of the price escalation provision options so as to permit writing options which meet the needs of each specific type of refiner. The object here is to reduce the time required to calculate the appropriate full payment price in the presence of changes in the market price for the product. Emphasis also is on changing the method used to calculate price changes so as to capture properly changes in the effective supply price of the refiner's product. Clearly, there may be some difficulty in writing an escalation clause that meets the commercial needs of a small refiner and at the same time protects DFSC from potential abuse. Nevertheless, DFSC should consider the possibility that the reduction in supply price gained from reducing the surcharge component by tailor-making price escalation clauses to the needs of intermediate-size and small refiners outweighs any potential risk to DFSC.

The cost of implementing these changes are small and can be accomplished without going outside DLA. The benefits are greatest during periods of rapid price increases.

2. On-Going Contracts

Another step that DFSC could take in an effort to reduce the supply price for product is to restructure the form of its contractual relationship with refiners. Specifically, DFSC should consider writing evergreen ("most favored seller")¹ contracts with a large number of refiners. The form of such a contract would be essentially the same as the form of the typical commercial contract. The contract would be presumed to be on going unless one or the other parties to the

¹A most-favored-seller contract could contain a provision stipulating that once a year (or some other appropriate time period) competitive bids would be accepted for the procurement covered by the contract. The "favored seller" would have the option of protecting his on-going contract by meeting the terms of the best responsive competitive offer.

contract gave notice of their intent to terminate. The actual length of time specifically covered by the contract might be quite short; however, the effective length of the contract would be indefinite. Such a contract, in essence, would establish an on-going commercial relationship between the buyer and the seller which would allow both parties to plan for the future on the basis of that relationship. One must remember that current DFSC contracts are for one year or less, and that those contracts are presumed to be terminated at the end of the contract period. As such, DFSC contracts are presently closed-end contracts.

The "presumed" renewal aspect of an evergreen contract, coupled with the notification period stipulation, would reduce significantly or eliminate completely the risk currently in a DFSC contract associated with the long lead times required to negotiate such a contract. This in turn should reduce the risk premium component of supply price. Moreover, to the extent that the number of items needing to be reviewed in each price negotiation period is reduced, the annual contracting and negotiating costs associated with the contract should also be reduced. This also should contribute to a reduction in the surcharge component of supply price.

A long-term contract has some of the advantages of a most-favored-seller contract. However, the long-term contract does entail the greater risk that at the end of a contract term the contract will not be renewed. In addition, the risk premium in a long-term contract could be larger because the refiner would be unable to change the terms of an undesirable contract as quickly.

The writing of most-favored-seller contracts with many refiners would allow DFSC to obtain the security of supply associated with a large number of crude sources and the logistical security of numerous and geographically dispersed

suppliers. The authority to change DFSC contracts to the most-favored-seller form resides within DLA. In fact, DFSC has had just such a contract with CalTex since 1948. The cost of implementing this recommendation is small.

3. Allocation

DFSC should consider reducing the riskiness of a DFSC contract by altering the default and allocation provisions of that contract. The most straightforward way to alter the default provision would be to include an allocation provision similar to that in a typical commercial contract.¹ If refiners were permitted to allocate DFSC in the same manner that they allocate their standard commercial customers, the risk of extraordinary default costs or costs associated with avoiding default would be eliminated. For many small and intermediate-size refiners, the reduction or elimination of the default or default avoidance risk should significantly lower the risk premium component of their supply price. The cost of implementing this recommendation is small and the authority to do so lies within DFSC.

A disadvantage of this recommendation is that such a clause would allow a refiner to allocate DFSC to less than full contract quantities if the refiner's crude supply were reduced. Thus, delivery of product to military users could be less than the required quantities, even though contract quantities covered the total requirement. The expected amounts delivered when allocation is allowed must be compared with the amount that DFSC would obtain if allocation were not allowed. If allocation were not allowed in some periods of uncertainty, DFSC could find that offers fall short of military requirements, as occurred in 1979. In that case, DFSC

¹ Subsequent to the completion of this study, DFSC has obtained approval for the inclusion of a modified allocation clause in its standard contract.

was, in effect, allocated before the contract period began. The question is, was the allocation greater or less than the amount DFSC would have been allocated if allocation had been allowed and a disruption of crude oil supplies had occurred? Chapter V provides a sensitivity analysis of possible scenarios. Actual information from 1979 indicates that DFSC's *de facto* allocation was indeed higher than the average amount that commercial customers were allocated during the same period.¹

4. Other Clauses and Contract Revisions

Other actions that could be taken to reduce the surcharge component of supply price include reducing the number of clauses in a DFSC contract not directly applicable to the refining industry and the way that industry does business. For example, elimination of the requirement for the submission of the voluminous quantities of sales and or cost data to DFSC should reduce the surcharge component. In addition, setting aside the Cost Accounting Standards requirements and, therefore, eliminating part of the motivation for large quantities of data to be submitted to DFSC also should contribute to a reduction in the surcharge component. In that same vein, DFSC should endeavor to alter the way the price-reasonableness range is calculated in order to reflect the existence of the other components of supply price besides alternate use value. To the extent that refiners believe that DFSC would be willing and able to pay the supply price, without the refiner incurring adverse political reaction on the basis of the prices charged to DFSC, refiners should be willing to increase offers made to DFSC. Finally, DFSC should endeavor to obtain the cooperation of other agencies in reducing the

¹ 1979 shortfall figures of six percent do not indicate the full impact of DFSC's procurement problem, since some of the original shortfall was subsequently made up.

number of socioeconomic clauses in the DFSC contract. It should be recognized that the applicability of various equal opportunity and small business subcontracting clauses to the actual activity involved in refining crude oil and supplying refined product to DFSC is extremely limited; therefore, the inclusion of such in a DFSC contract increases the surcharge component of supply price without affecting significantly refiner behavior.

B. INDIRECT ACQUISITION OF FINAL PRODUCTS

An alternative to the direct acquisition of refined product is the indirect acquisition of product made possible by acquiring crude oil and transforming that crude in one way or another into usable refined product. This paper also considers the possibility of barter for refined product or crude oil as a method of indirect acquisition of product. This section summarizes the strengths and weaknesses of these alternative techniques for the acquisition of product in terms of DFSC's efforts to fulfill successfully its mission. A fuller analysis of these options is presented in Chapter VI.

The cost of product or crude oil obtained using barter would tend to be greater for any given quantity than the price of product of crude obtained by direct purchase. This method thus would tend to increase the supply price of refined product to DFSC.

A number of procurement options fall into the category of acquiring crude oil and transforming it into product. This acquisition category includes acquiring crude oil from either domestic or foreign sources. It also includes a number of methods of transforming crude oil into product, such as using government-owned refining capacity, entering into processing agreements with refiners, or engaging in crude-for-product exchange agreements.

All options that involve the acquisition of crude oil have the property that, in general, the cost to government for specific quantities of product acquired would be higher than if equal quantities of final product were acquired directly. As a small, relatively inexperienced and restricted operator in the petroleum industry, DFSC would, on average, pay higher prices for inputs and have higher costs of operations. The more transactions that must be made, especially under government contract regulations and procedures, the higher the ultimate price of product. In addition, the risks of ownership would fall on DFSC.

Furthermore, the options that involve DFSC acquiring crude oil can imply a greater risk of procurement shortages due to reliance on a smaller number of sources of crude oil (as compared to the greater number of sources when final product is procured directly).¹ In addition, as owner of the crude oil, DFSC would incur all the risks associated with sole ownership. For example, if a tanker of DFSC oil is lost in the Persian Gulf because of accident, act of God, terrorist activities, etc., DFSC would bear the full brunt of the loss. On the other hand, if that tanker belonged to a major oil company, all customers of that major oil company would share in the loss.

In summary, using crude oil acquisition options raises the effective supply price for product and thus reduces the supply available to DFSC. Moreover, the risk of supply disruption or non-delivery would be greater than the risk associated with direct acquisition methods.

¹Comparison of sources of supply requires comparison of both the number of sources and the company of origin.

